73® Amateur Radio Today

MAY FOOL 1999
ISSUE #463
USA $3.95
CANADA $4.95

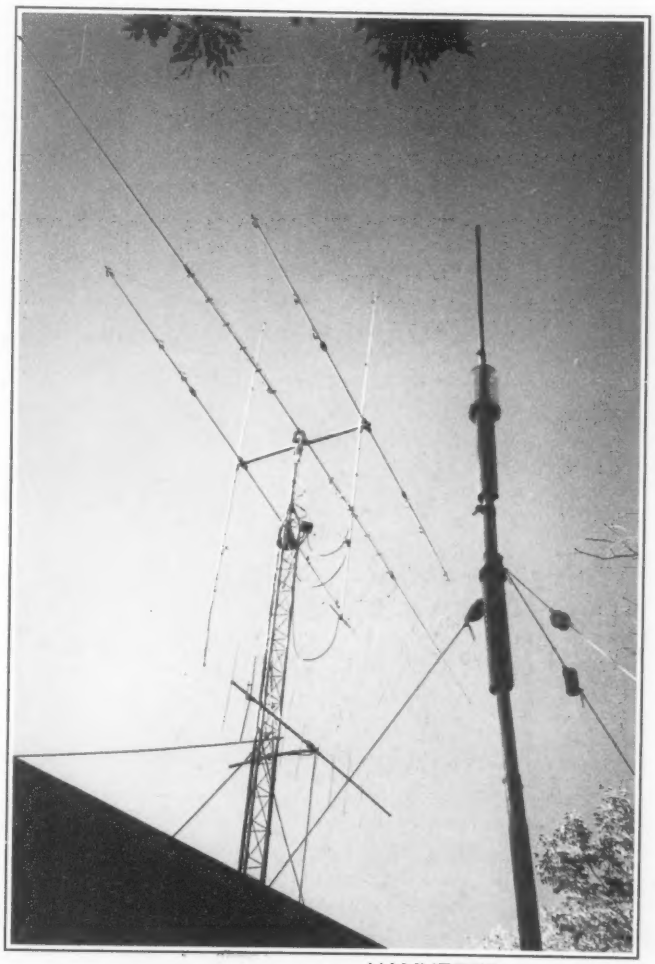
To Build:

20m Shortie Antenna

Triband Vertical

Cantenna Load

Card-File QRP Xcvr



HAMVERTS — page 33

Review:

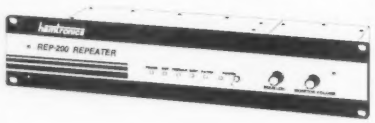
Hamtronics T301 Exciter

||.|..||.|....|||.....||....||.|.|.|.|...||.||...|
**********5-DIGIT 48103
#00000191940MR5# JUN76 214
SERIALS PROCESSING DEPT 45
UNIV MICROFILMS IT P 1
300 N ZEEB RD
ANN ARBOR MI 48103-1553

Get more features for your dollar with our

REP-200 REPEATER

A microprocessor-controlled repeater with full auto-patch and many versatile dtmf remote control features at less than you might pay for a bare bones repeater or controller alone!



- ***kit still only $1095***
- ***factory assembled still only $1295***

50-54, 143-174, 213-233, 420-475 MHz. (902-928 MHz slightly higher.)

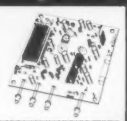
➡ **FCC type accepted** for commercial service in 150 & 450 MHz bands.

Digital Voice Recorder Option. Allows message up to 20 sec. to be remotely recorded off the air. Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements! ..... only $100.**

REP-200C Economy Repeater. Real-voice ID, no dtmf or autopatch. ..... Kit only $795, w&t $1195.

REP-200N Repeater. Without controller so you can use your own. ..... **Kit only $695, w&t $995.**

You'll KICK Yourself
If You Build a Repeater
Without Checking Out Our Catalog First!



Hamtronics has the world's most complete line of modules for making repeaters. In addition to exciters, pa's, and receivers, we offer the following controllers.

COR-3. Inexpensive, flexible COR module with timers, courtesy beep, audio mixer. ..... **only $49/kit, $79 w/t.**

CWID. Traditional diode matrix ID'er. ..... **kit only $59.**

CWID-2. Eprom-controlled ID'er. ..... **only $54/kit, $79 w/t.**

DVR-1. Record your own voice up to 20 sec. For voice id or playing club announcements. ..... **$59/kit, $99 w/t.**

COR-4. Complete COR and CWID all on one board. ID in eprom. Low power CMOS. ..... **only $99/kit, $149 w/t.**

COR-6. COR with real-voice id. Low power CMOS, non-volatile memory. ..... **kit only $99, w/t only $149.**

COR-5. µP controller with autopatch, reverse ap, phone remote control, lots of DTMF control functions, all on one board, as used in REP-200 Repeater. ..... **$379 w/t.**

AP-3. Repeater autopatch, reverse autopatch, phone line remote control. Use with TD-2. ..... **kit $89.**

TD-2. Four-digit DTMF decoder/controller. Five latching on-off functions, toll call restrictor. ..... **kit $79.**

TD-4. DTMF controller as above except one on-off function and no toll call restrictor. Can also use for selective calling; mute speaker until someone pages you. ..... **kit $49.**

SUBAUDIBLE TONE ENCODER/DECODER

Access all your favorite closed repeaters!

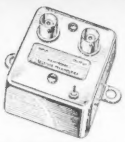
- **Encodes** all standard CTCSS tones with crystal accuracy and convenient DIP switch selection.
- Comprehensive manual also shows how you can set up a front panel switch to select tones for several repeaters.
- Decoder can be used to mute receive audio and is optimized for installation in repeaters to provide closed access. High pass filter gets rid of annoying buzz in receiver. ☺ **New low prices!**

- TD-5 CTCSS Encoder/Decoder Kit ..... now only **$29**
- TD-5 CTCSS Encoder/Decoder Wired/tested **$49**

LOW NOISE RECEIVER PREAMPS

LNG-( ) GaAs FET PREAMP

STILL ONLY $59, wired/tested



- Make your friends sick with envy! Work stations they don't even know are there.
- Install one at the antenna and overcome coax losses.
- *Available for 28-30, 46-56, 137-152, 152-172, 210-230, 400-470, and 800-960 MHz bands.*

LNW-( ) ECONOMY PREAMP

ONLY $24/kit

- Miniature MOSFET Preamp
- Solder terminals allow easy connection inside radios.
- *Available for 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, and 400-500 MHz bands.*

TRANSMITTING & RECEIVING CONVERTERS

No need to spend thousands on new transceivers for each band!

- Convert vhf and uhf signals to & from 10M.
- Even if you don't have a 10M rig, you can pick up very good used xmtrs & rcvrs for next to nothing.
- Receiving converters (shown above) available for various segments of 6M, 2M, 220, and 432 MHz.
- Rcvg Conv Kits from $49, wired/tested units only $99.

- Transmitting converters for 2M, 432 MHz.
- Kits only $89 vhf or $99 uhf.
- Power amplifiers up to 50W output.

WEATHER ALERT RECEIVER

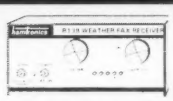
A sensitive and selective professional grade receiver to monitor critical NOAA weather broadcasts. Good reception even at distances of 70 miles or more with suitable antenna. No comparison with ordinary consumer radios!

Automatic mode provides storm watch, alerting you by unmuting receiver and providing an output to trip remote equipment when an alert tone is broadcast. Crystal controlled for accuracy; **all 7 channels** (162.40 to 162.55).

Buy just the receiver pcb module in kit form or buy the kit with an attractive metal cabinet, AC power adapter, and built-in speaker. Also available factory wired and tested.

RWX Rcvr **kit**, PCB only $79
RWX Rcvr **kit with cabinet, speaker, & AC adapter** $99
RWX Rcvr **wired/tested in cabinet with speaker & adapter** $139

WEATHER FAX RECEIVER



Join the fun. Get striking images directly from the weather satellites!

A very sensitive wideband fm receiver **optimized for NOAA** APT & Russian Meteor **weather fax** on the 137MHz band.

Designed from the start for optimum satellite reception; not just an off-the-shelf scanner with a shorted-out IF filter!

Covers all 5 satellite channels. Scanner circuit & recorder control allow you to automatically capture signals as satellites pass overhead, even while away from home.

- R139 Receiver Kit less case $159
- R139 Receiver Kit with case and AC power adapter $189
- R139 Receiver w/t in case with AC power adapter ...$239
- Internal PC Demodulator Board & Imaging Software $289
- Turnstile Antenna $119
- Weather Satellite Handbook $20

SYNTHESIZED FM EXCITER & RECEIVER MODULES

NEW

We recently introduced new vhf fm exciters and receivers which do not require channel crystals. NOW... uhf modules are also available!

Exciters and Receivers provide high quality nbfm and fsk operation. Features include:

- ***Dip switch frequency selection.***
- ***Exceptional modulation for voice and class.***
- ***Very low noise synthesizer for repeater service.***
- ***Direct fm for data up to 9600 baud.***
- ***TCXO for tight frequency accuracy in wide range of environmental conditions.***
- ***Next day shipping. No wait for crystals.***

EXCITERS:

Rated for continuous duty, 2-3W output.

T301 VHF Exciter: for various bands 139-174MHz*, 216-226 MHz.

- Kit (ham bands only) ...**$109** (TCXO option $40)
- Wired/tested, incl TCXO...**$189**

T304 UHF Exciter: various bands 400-470 MHz*.

- Kit (440-450 ham band only) incl TCXO ...**$149**
- Wired/tested...**$189**

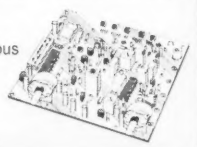
* for gov't & export use.

RECEIVERS:

R301 VHF Receiver: various bands 139-174MHz*, 216-226 MHz.

- **Kit** (ham bands only) ....**only $139** (TCXO option $40)
- **Wired/tested** ..**$209** (includes TCXO)

R304 UHF Receiver: various bands 400-470 MHz*.



- Kit (440-450 ham band only) incl TCXO ...**$179**
- Wired/tested...**$209**

TRADITIONAL CRYSTAL-CONTROLLED VHF & UHF FM EXCITERS & RECEIVERS

FM EXCITERS: 2W output, continuous duty.

- TA51: for 6M, 2M, 220 MHz ..... **kit $99, w/t $169**
- TA451: for 420-475 MHz. ..... **kit $99, w/t $169**
- TA901: for 902-928 MHz, (0.5W out) ..... **w/t $169**

VHF & UHF POWER AMPLIFIERS:

Output levels from 10W to 100W..... **Starting at $99**

FM RECEIVERS:

Very sensitive – 0.15µV.

Superb selectivity, >100 dB down at ±12 kHz, best available anywhere, flutter-proof squelch. For 46-54, 72-76, 140-175, or 216-225 MHz. ... **kit $129, w/t $189**

- R144 RCVR. Like R100, for 2M, with helical resonator in front end..... **kit $159, w/t $219**
- R451 FM RCVR, for 420-475 MHz. Similar to R100 above. kit $129, w/t $189.
- R901 FM RCVR, 902-928MHz ..... **$159, w/t $219**

WWV RECEIVER

Get time & frequency checks without buying multiband hf rcvr. Hear solar activity reports affecting radio propagation.

Very sensitive and selective crystal controlled superhet, dedicated to listening to WWV on 10 MHz. Performance rivals the most expensive rcvrs.

- RWWV Rcvr kit, PCB only $59
- RWWV Rcvr kit with cabt, spkr, & 12Vdc adapter $89
- RWWV Rcvr w/t in cabt with spkr & adapter $129

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FT-3000M

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$177.50

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Mini Dualband

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New IC-706G* IC-706 MK II
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DSP Now Included

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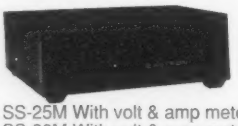
	CONT.	ICS	WT.(LBS)
SS-10	7	10	3.2
SS-12	10	12	3.4
SS-18	15	18	3.6
SS-25	20	25	4.2
SS-30	25	30	5.0



SS-25M With volt & amp meters
SS-30M With volt & amp meters

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

- LOW PROFILE POWER SUPPLY

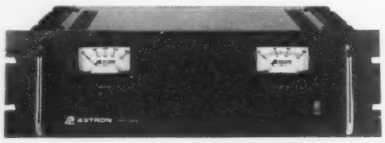
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

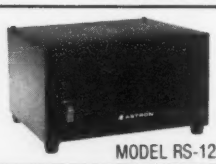
VS-M AND VRM-M SERIES

MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
VS-70M	67	34	16	70	6 x 13¾ x 12⅛	48
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES



MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

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73 Amateur Radio Today

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REVIEW

20 Our Exciting New Fox — WB9RRT
How one club settled on the Hamtronics T301.

Web Page	E-Mail
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On the cover: WZ8A compared his vertical to a quad, page 33. Photo courtesy of WZ8A. We are always looking for interesting articles and cover photos — with or without each other. Your name could be in this space *next* month, and our check could be on its way to *you!* You couldn't use a little extra cash?

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

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NEVER SAY DIE

Wayne Green W2NSD/1
w2nsd@aol.com

The May Fool Issue

"Where the hell is my damned April issue?" you're probably asking. Well, I cleaned that up a bit, since this is supposedly a family magazine, but that's probably the gist of your response to getting a May and no April issue of *73*.

Gee, mumble, mumble, you see, ahem, it was like this. We were stuck for something really unusual to do for the April issue that would get your attention and give you something to talk about on the air for a change. So Frances, our Associate Publisher, said that since our subscription fulfillment agency is so screwed up with the Y2K mess that they made us miss our press date for the April issue, let's put out the first totally invisible issue of the magazine for April and extend everyone's subscription by a month.

"But," I protested, "that'll mean that our subscribers will miss seeing our first frontal nude YL cover!"

"Tough tiddledywinks," Frances answered.

And, since Frances does most of the work around here, I tend not to argue with her. So I don't want to hear any bitching about the missing April issue. Permission is granted to talk about this May Fool issue as much as you want. And I'm sorry you missed getting the first frontal nude YL ham magazine cover in history. However, knowing how ridiculously straight-laced you are, it probably would have offended you and you'd have cancelled your subscription in anger.

Say, that's not a bad idea! I don't do refunds when subscribers cancel in anger, so we'd just have to print and mail fewer magazines. It could save us a bundle. Let's see, I've already offended all of the ARRL lackeys, gays, liberals and child molesters. Any suggestions on which group I should target next?

You Can Trust Your Doctor

Sure, with your life. You get sick, you go to the doctor, and you believe what he says. Well, that's what our parents teach us. That's what they were taught.

My grandmother worked it differently. She got sick and her doctor told her to stop drinking coffee. So she had to go to two more doctors before she found one that didn't say anything about her coffee drinking.

So I keep researching the medical industry and finding some gems. I'll bet you didn't know that 15,000 new drugs are marketed each year, and that 12,000 eventually have to be withdrawn. You know they're not going to withdraw a drug that isn't causing serious side effects. According to the FDA 1.5 million Americans were hospitalized in one year alone as a result of drugs that were prescribed to "cure" them. Worse, 30% of all hospitalized people suffered further damage from the therapy prescribed for them. Recently, the AMA *Journal* reported that there are 180,000 medically induced deaths each year in the US. And we're fussing about Dr. Kevorkian!

How safe are the drugs our doctors are prescribing? The statistics are not encouraging. Medicine is far from an exact science, and the odds are that your doctor is far from current in his knowledge of what's safe and what's not. Studies have shown that doctors get almost all of their data on drugs from the drug company salesmen — called detail men — and not from medical journals.

New drugs are tested on animals. Well, that's the cheapest way. The problem with this is that many drugs react differently in animals than people. It's bad enough that all people are different. We all look different, have different genes, different voices, different fingerprints, different allergies, and so on. So, just as the same drug often affects different animals differently, it can also affect different people quite differently. Vaccinations that immunize some people kill others, or can cause deafness, as with Miss America a couple years back. Deaf for life from a childhood vaccination.

There's much to be said for not making your body sick in the first place. But that's your choice.

Fighting City Hall

It doesn't pay, right? Well, they have that one right!

I got to thinking (hey, it happens!), that if you'd pay attention to what I've found with my research, and pass the word along, that we could upset some very large apple carts. But then I remember that Jesus was a contrarian who fought the establishment — you know, the money-changers — and here we are, 2000 years later, heading for 3000, and the money-changers are still in charge.

So which establishments am I fighting? Well, there's the $1.5 trillion "health care" industry, which would be devastated if enough people stopped getting sick via my *Secret Guide to Health*. How many trillions are involved with the food giants and the sugar industry? If you'd read what I've discovered, or check my resources, these industries would collapse. Read *Beating The Food Giants*, a $10 book by Paul Stitt, and *Lick The Sugar Habit*, a $6 book by Nancy Appleton, if you think I'm exaggerating.

With my *Cold Fusion Journal* I'm trying to help upset the oil, coal, and natural gas industries, their network of gas stations, plus the power companies and their power grid. See if you can figure out how big those industries are.

Then there's the public school industry and the teacher unions that control it, you, and your children.

When you consider that most of the media is bought and paid for by the giants I'd like to upset, you can see why my message isn't popular with radio, TV, magazines, newspapers, and so on. They all owe their existence to the trillions of advertising dollars poured into them by the establishments I'm fighting.

There is *no* industry supporting the growth and sale of healthy food to turn to for help. Eating raw food is a powerful first step, but even that is being grown by food giants on mineral-depleted land, complete with pesticides. Where can you be sure of getting meat that isn't packed with hormones and antibiotics?

Worker

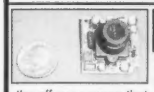
Like the ants and the bees, we're raised and taught to be workers. The pressure comes from every side to convince us that we must be workers. Is that what you want to be all your life, a worker? Blue collar or white collar, is that what you want for your kids — to

Continued on page 58

World's Smallest TV Transmitters

We call them the 'Cubes'.... Perfect video transmission from a transmitter you can hide under a quarter and only as thick as a stack of four pennies- that's a nickel in the picture! Transmits color or B&W with fantastic quality - almost like a direct wired connection to any TV tuned to cable channel 59. Crystal controlled for no frequency drift with performance that equals law enforcement models that cost hundreds more! Basic 20 mW model transmits up to 300' while the high power 100 mW unit goes up to 1/4 mile. Audio units include sound using a sensitive built-in mike that will hear a whisper 15 feet away! Units run on 9 volts and hook-up to most any CCD camera. Any of our cameras have been tested to mate perfectly with our Cubes and work great. Fully assembled - just hook-up power and you're on the air!

C-2000, Basic Video Transmitter Cube.....$89.95
C-3000, Basic Video & Audio Transmitter Cube.....$149.95
C-2001, High Power Video Transmitter Cube.....$179.95
C-3001, High Power Video & Audio Transmitter Cube...$229.95



CCD Video Cameras

Top quality Japanese Class 'A' CCD array, over 440 line line resolution, not the off-spec arrays that are found on many other cameras. Don't be fooled by the cheap CMOS single chip cameras which have 1/2 the resolution, 1/4 the light sensitivity and draw over twice the current! The black & white models are also super IR (Infra-Red) sensitive. Add our invisible to the eye, IR-1 illuminator kit to see in the dark! Color camera has Auto gain, white balance, Back Light Compensation and DSP! Available with Wide-angle (80º) or super slim Pin-hole style lens. Run on 9 VDC, standard 1 volt p-p video. Use our transmitters for wireless transmission to TV set, or add our IB-1 Interface board kit for audio sound pick-up and super easy direct wire hook-up to any Video monitor, VCR or TV with A/V input. Fully assembled, with pre-wired connector.

CCDWA-2, B&W CCD Camera, wide-angle lens.....$69.95
CCDPH-2, B&W CCD Camera, slim fit pin-hole lens.....$69.95
CCDCC-1, Color CCD Camera, wide-angle lens.....$129.95
IR-1, IR Illuminator Kit for B&W cameras.....$24.95
IB-1, Interface Board Kit.....$14.95

Mini Radio Receivers

Imagine the fun of tuning into aircraft a hundred miles away, the local police/fire department, ham operators, or how about Radio Moscow or the BBC in London? Now imagine doing this on a little radio you built yourself - in just an evening! These popular little receivers are the nuts for catching all the action on the local ham, aircraft, standard FM broadcast radio, shortwave or WWV National Time Standard radio bands. Pick the receiver of your choice, each easy to build, sensitive receiver has plenty of crystal clear audio to drive any speaker or earphone. Easy one evening assembly, run on 9 volt battery, all have squelch except for shortwave and FM broadcast which has handy SCA output. Add our snazzy matching case and knob set for that smart finished look.

AR-1, Airband 108-136 MHz Kit.....$29.95
HFRC-1, WWV 10 MHz (crystal controlled) Kit.....$34.95
FR-1, FM Broadcast Band 88-108 MHz Kit.....$24.95
FR-6, 6 Meter FM Ham Band Kit.....$34.95
FR-10, 10 Meter FM Ham Band Kit.....$34.95
FR-146, 2 Meter FM Ham Band Kit.....$34.95
FR-220, 220 MHz FM Ham Band Kit.....$34.95
SR-1, Shortwave 4-11 MHz Band Kit.....$29.95
Matching Case Set (specify for which kit).....$14.95

Tiny FM Transmitters

Gosh, these babies are tiny - that's a quarter in the picture! Choose the unit that's best for you. FM-5 is the smallest tunable FM transmitter in the world, picks up a whisper 10' away and transmits up to 300'. Runs on tiny included watch battery, uses SMT parts. FM-4 is larger, more powerful, runs on 5-12 volts, goes up to a mile. FM4,5 operate in standard FM band 88-108 MHz. FM-6 is crystal controlled in 2 meter ham band, 146.535 MHz, easily picked up on scanner or 2 meter rig, runs on 2 included watch batteries. SMT (surface mount) kits include extra parts in case you sneeze & loose a part!

FM-4MC, High Power FM Transmitter Kit.....$17.95
FM-5, World's Smallest FM Transmitter Kit.....$19.95
FM-6, Crystal Controlled 2M FM Transmitter Kit.....$39.95
FM-6, Fully Wired & Tested 2M FM Transmitter.....$69.95

Super Pro FM Stereo Transmitter

Professional synthesized FM Stereo station in easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set freq with Up/Down buttons, big LED display. Input low pass filter gives great sound (no more squeals or swishing from cheap CD inputs!) Limiters for max 'punch' in audio - without over mod, LED meters to easily set audio levels, built-in mixer with mike, line level inputs. Churches, drive-ins, schools, colleges find the FM-100 the answer to their transmitting needs, you will too. Great features, great price! Kit includes cabinet, whip antenna, 120 VAC supply. *We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.*

FM-100, Pro FM Stereo Transmitter Kit.....$249.95
FM-100WT, Fully Wired High Power FM-100.....$399.95

FM Stereo Radio Transmitters

No drift, microprocessor synthesized! Excellent audio quality, connect to CD player, tape deck or mike mixer and you're on-the-air. Strapable for high or low power! Runs on 12 VDC or 120 VAC. Kit includes case, whip antenna, 120 VAC power adapter - easy one evening assembly.

FM-25, Synthesized FM Stereo Transmitter Kit....$129.95

Lower cost alternative to our high performance transmitters. Great value, tunable over FM band, plenty of power and manual goes into great detail about antennas, range and FCC rules. Handy kit for sending music thru house and yard, ideal for school projects too - you'll be amazed at the exceptional audio quality! Runs on 9V battery or power from 5 to 15 VDC. Add our matching case and whip antenna set for a nice 'pro' look.

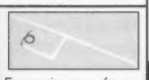
FM-10A, Tunable FM Stereo Transmitter Kit.....$34.95
CFM, Matching Case and Antenna Set.....$14.95
FMAC, 12 Volt DC Wall Plug Adapter.....$9.95

RF Power Booster

Add muscle to your signal, boost power up to 1 watt over a freq range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM transmitters, providing radio service through an entire town. Runs on 12 VDC. For a neat finished look, add the nice matching case set.

LPA-1, Power Booster Amplifier Kit.....$39.95
CLPA, Matching Case Set for LPA-1 Kit.....$14.95
LPA-1WT, Fully Wired LPA-1 with Case.....$99.95

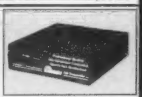
FM Station Broadcast Antenna



For maximum performance, a good antenna is needed. Properly tuned and matched antenna is fully PVC enclosed for weather protection and rugged use. Vertical or horizontal mounting, 'F' style connector, 5' long.

TM-100, Tru-Match FM Station Antenna Kit.....$39.95

AM Radio Transmitter



Operates in standard AM broadcast band, set to clear channel in your area. AM-25 'pro' version is synthesized for stable, no-drift frequency and is setable for high power output where regulations allow, typical range of 1-2 miles. Entry-level AM-1 has tunable transmit oscillator, runs FCC maximum 100 mw power, expected range 1/4 mile. Both accept line-level inputs from tape decks, CD players or mike mixers, run on 12 volts DC. Pro AM-25 includes AC power adapter, matching case and bottom loaded wire antenna. Entry-level AM-1 has an available matching case and knob set for a finished, professional look. High level modulation for low distortion.

AM-25, Professional AM Transmitter Kit.....$129.95
AM-1, Entry level AM Radio Transmitter Kit.....$29.95
CAM, Matching Case Set for AM-1.....$14.95

RAMSEY

Binocular Special

Wow, did we nab a deal on these first rate binoculars! Absolutely identical to a famous big name brand here in Rochester, NY - but without 'their' name. Well made with fully coated optics, super nice rubber armored housing over hi-alloy aluminum, includes lens cleaner cloth, neck lanyard and carry case. 4 styles: roof prism 10x25 (10 power, 25 mm), 10x25 high performance roof prism ruby coated objective lens model for demanding use in bright sun, 10x25 high-end BAK-4 lens porro prism ruby coat with TacGrip housing, and Ultra-View 10x50 porro prism ruby coats. First quality, yet at a close-out price on the exact same units as the 'Trademarked' units - but at half price!

BNO-M, 8x21 Mini Monocular.....$14.95
BNO-1, 10x25 Roof Prism Binoculars.....$24.95
BNO-1EX, 10x25 Ruby Coated Porro Prism.....$29.95
BNO-2, 10x25 TacGrip Ruby Coat Porro Prism.....$59.95
BNO-6, 10x50 Ultra-View Ruby Coat Porro Prism...$69.95

World's Smallest FM Radios

Everyone who sees one of these babies says they just gotta have one! Super cute tiny FM radios have automatic scan/search tuning, comfortable ear bud earphones and we even include the battery. The pager style unit looks like a shrunken pager and even has an LCD clock built-in. You will be amazed at the crystal clear amazing sound! That's a quarter in the picture for size comparison - pretty tiny, huh?

MFMT-1, World's Smallest FM Radio.....$11.95
PFMR-1, Pager Style LCD Clock & FM Radio.....$12.95

Speech Descrambler

Decode all that gibberish! This is the popular descrambler / scrambler that you've read about in all the Scanner and Electronic magazines. Speech inversion technology is used, which is compatible with most cordless phones and many police department systems, hook it up to your scanner speaker terminals and you're in business. Easily configured for any use: mike, line level and speaker output/inputs are provided. Also communicate in total privacy over telephone or radio, full duplex operation - scramble and unscramble at the same time. Easy to build, all complex circuitry contained in new custom ASIC chip for clear, clean audio. Runs on 9 to 15VDC. Our matching case set adds a professional look to your kit.

SS-70A, Speech Descrambler/Scrambler Kit.....$39.95
CSS, Custom Matching Case and Knob Set.....$14.95
SS-70AWT, Fully Wired SS-70A with Case.....$79.95
AC12-5, 12 Volt DC Wall Plug Adapter.....$9.95

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QRX . . .

Ishmod Found?

Long-time readers of *73* may recall the saga of Ishmod Kaduk S7Z2B, a hard-luck Sikkimese ham whose DXpeditioning story was first reported in these pages during 1984 and 1985. Along with four companions, Kaduk apparently disappeared while investigating some strange propagation phenomena in the Bay of Bengal southeast of an area known as Chilka Lake (about 200 air miles south of Calcutta). According to Indian and U.S. authorities at the time (one of the companions was an American, Shelby Hator-Baroda), hope for the quintet was not great, given the savagery of local pirate gangs in that area of the world.

Now it seems that Ishmod, at least, may have made it and indeed even been found—thanks to the recent unrest in Indonesia. Two separate readers have sent us independent reports of a newspaper photo of someone bearing a quite older but still remarkable likeness to the photo of Ishmod we published on page 24 of our April 1985 issue. We have copies of this photo being sent to us as this issue goes to press, and Ishmod's rather affluent family is en route from Sikkim to continue the investigation at the scene of the reports, the Banjak Islands. They hope to arrive about April 1, ironically the western calendar equivalent of Ishmod's birthday. More on this in upcoming issues (please don't call for updates!) ...

Name Change?

The American Radio Relay League (ARRL) is considering the possibility of changing its name to something more appropriate for the technological progress of the 21st century.

The subject came up at a recent ARRL Board meeting, when directors requested the Executive Committee to submit some new name possibilities for consideration at their July, 1999, get-together.

At a time when hams are concerned about future FCC licensing privileges, competition with the Internet, and overcoming the stagnation in ARRL membership, Board members believe now is a good time to reconsider the organization's name and its appeal for attracting more members into the hobby.

It was ARRL founder Hiram Percy Maxim who in 1914 suggested that the organization's name should be the American Amateur Radio League. But he was voted down in favor of the current name.

However, in recent years there have been a growing number of radio amateurs who have criticized the "radio relay" terminology in the name. They maintain that the era of relaying radio messages is ancient history, and furthermore turns off potential members.

This is the second time in this decade that ARRL's Board has studied the possibility of a name change. In November, 1992, a *QST* magazine article sought opinions from members on the subject, but the Board tabled action on the possibility in January, 1993.

The League is encouraging suggestions ...

Tnx and a don't get us started to Ed Collins KC9RL, via the North Shore (MA) Radio Club *Transmitter.*

Sunrayce '99

Ham radio will play a key role in Sunrayce '99. Sunrayce is a biannual event that pits college-built solar-powered cars in a race across part of the United States. This year, Bill Eccles KE4VT has been appointed the event's ham radio communications coordinator.

Sunrayce '99 begins in Washington on June 20th. Overnight stops are scheduled for Charlottesville, Raleigh, Charlotte, Clemson and Atlanta at Georgia Tech. Then it's on to Macon, Tallahassee, and Ocala to finish up at the Disney Epcot Center in Orlando on June 29th. Eccles says that a lot of hams are needed to work on Sunrayce '99 communications. If you want to take part you can E-mail him at [William.Eccles@Rose-Hulman.edu].

Tnx and a don't forget to put your ears on to the *SERA Repeater Journal*, via *Newsline*, Bill Pasternak WA6ITF, editor.

ARRL E-mail

ARRL members can now announce their ARRL membership through their E-mail addresses. Starting February 1, 1999, a new membership service was available for those wishing to have an ARRL E-mail address, and you didn't have to switch E-mail services to do it. Not only that, but it is free-of-charge for League members.

The new, personalized League E-mail addresses will consist of the member's callsign@arrl.net. Electronic mail sent to the address automatically will be forwarded to any E-mail account you choose.

As long as you remain an ARRL member, you'll never have to notify people of an address change—even if you change Internet Service Providers.

Members are able to sign up quickly and easily through the ARRL Members Only Web site. If you are not already registered for the Members Only Web site, you can do so at [http://www.arrl.org/members/].

Members who are not registered for the Members Only Web site may also obtain their League addresses, but the procedure is a bit more time consuming. For instructions, send a blank message to [subscribe@arrl.net].

Tnx and a so that's what the dues increase was for to the ARRL, via the *marcKey,* newsletter of the Manteca (CA) ARC, Cathy Ledbetter KE6UTO, editor.

Heroic Texas Hams

After nearly two weeks of flood duty last fall, hams in Texas were battered but not beaten. Some individual stories of dedication and heroism also have begun to emerge from within the amateur radio ranks.

Many residents displaced by the flooding were forced to remain in Red Cross shelters for over a week. More than two dozen people died. South Texas Section Manager Ray Taylor N5NAV reported that at one point, hundreds of hams were active in Texas, Louisiana, Oklahoma, and Arkansas, handling various flood-related duties ranging from net control to shelter communication.

"We've had awful good cooperation," Taylor said. Some hams from as far away as Nacogdoches, near the Louisiana border, volunteered. Hams manning shelters got some relief when the Red Cross was able to get cell phones. "We are beginning to secure the Red Cross net here in San Antonio," Bexar County EC Neil Martin WA5FSR said after a few hectic days. There were still shelters open, but the Red Cross was prepared to handle everything by cell phone unless more problems developed.

Martin had said the net control station at the Red Cross was being staffed around the clock because they were "using a VHF/UHF linked system to communicate with shelters in Cuero, Victoria, and other areas toward the coast."

Martin singled out three San Antonio-area hams for special recognition—Shelter Communications Manager Bobby Rodriguez K5AUW, Red Cross Liaison Stan Stanukinos KA5IID, and Teri Thomas KC5BJI. "Bobby and Stan have been at the Red Cross communications center almost continuously since Saturday afternoon with only snatches of rest," he said. "Teri has done yeoman service in finding and scheduling operators."

Taylor said prompt response by a ham couple in his area, Comal County, made the difference between life and death for some residents of a flooded mobile home park there. Taylor said husband-and-wife team Susan and Leo Manor, NFØT and NØERI, went down to the trailer park to check out the situation. "Nobody had warned these people," Taylor said of the residents. Using their vehicle, the Manors were able to pull several trailers to higher ground before the water got too deep.

Continued on page 8

MFJ 1.8-170 MHz SWR Analyzer™

Reads complex impedance . . . Super easy-to-use

New MFJ-259B reads antenna SWR . . . Complex RF Impedance: Resistance(R) and Reactance(X) or Magnitude(Z) and Phase(degrees) . . . Coax cable loss(dB) . . . Coax cable length and Distance to fault . . . Return Loss . . . Reflection Coefficient . . . Inductance . . . Capacitance . . . Battery Voltage. LCD digital readout . . . covers 1.8-170 MHz . . . built-in frequency counter . . . side-by-side meters . . . Ni-Cad charger circuit . . . battery saver . . . low battery warning . . . easy access battery panel . . . smooth reduction drive tuning . . .

The world's most popular SWR analyzer just got incredibly better and gives you more value than ever!

MFJ-259B gives you a complete picture of your antenna's performance. You can read antenna SWR and Complex Impedance from 1.8 to 170 MHz.

You can read Complex Impedance as series resistance and reactance (R+jX) or as magnitude (Z) and phase (degrees).

You can determine velocity factor, coax cable loss in dB, length of coax and distance to a short or open in feet.

You can read SWR, return loss and reflection coefficient at any frequency simultaneously at a single glance.

You can also read inductance in uH and capacitance in pF at RF frequencies.

Large easy-to-read two line LCD screen and side-by-side meters clearly display your information.

It has built-in frequency counter, Ni-Cad charger circuit, battery saver, low battery warning, easy access battery panel and smooth reduction drive tuning.

Super easy to use! Just set the bandswitch and tune the dial -- just like your transceiver. SWR and Complex Impedance are displayed instantly!

Here's what you can do

Find your antenna's true resonant frequency. Trim dipoles and verticals.

Adjust your Yagi, quad, loop and other antennas, change antenna spacing and height and watch SWR, resistance and reactance change instantly. You'll know exactly what to do by simply watching the display.

Perfectly tune critical HF mobile antennas in seconds for super DX -- without subjecting your transceiver to high SWR.

Measure your antenna's 2:1 SWR bandwidth on one band, or analyze multiband performance over the entire spectrum 1.8-170 MHz!

Check SWR outside the ham bands without violating FCC rules.

Take the guesswork out of building and adjusting matching networks and baluns.

Accurately measure distance to a short or open in a failed coax. Measure length of a roll of coax, coax loss, velocity factor and impedance.

Measure inductance and capacitance. Troubleshoot and measure resonant frequency and approximate Q of traps, stubs, transmission lines, RF chokes, tuned circuits and baluns.

Adjust your antenna tuner for a perfect 1:1 match without creating QRM.

And this is only the beginning! The MFJ-259B is a complete ham radio test station including -- frequency counter, RF signal generator, *SWR Analyzer*™, RF Resistance and Reactance Analyzer, Coax Analyzer, Capacitance and Inductance Meter and much more!

Call your dealer for your best price! MFJ-259B **$249.95**

Call or write for *Free Manual*

MFJ's comprehensive instruction manual is packed with useful applications -- all explained in simple language you can understand.

Take it anywhere

Fully portable, take it anywhere -- remote sites, up towers, on DX-peditions. It uses 10 AA or Ni-Cad batteries (not included) or 110 VAC with MFJ-1315, $14.95. Its rugged all metal cabinet is a compact 4x2x6¾ inches.

How good is the MFJ-259B?

MFJ *SWR Analyzers*™ work so good, many antenna manufacturers use them in their lab and on the production line -- saving thousands of dollars in instrumentation costs! Used worldwide by professionals everywhere.

More MFJ *SWR Analyzers*™

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LETTERS

From the Ham Shack

Burt Syverson K5CW, Plano TX. Very frequently in Letters to the Editor columns of amateur radio journals, we read letters complaining about the on-the-air antics of other amateurs whom most of us are ashamed of. However, these kinds of complaints are also seen in other publications outside of amateur radio, ones such as newspapers. These may be about kiddy-porn on the Internet or other such things, but they do have one common underlying theme. The writers of these letters are saying "I do not like this situation, I have done my part, I got it off of my chest by telling you about it and now I would like somebody else to do something about it, because I do not want to myself."

How nice it would be if it were just that simple, but it isn't. In these two situations, electronic communications is involved and supposedly the somebody who is supposed to pick up on these complaints and do something about it is the FCC. We amateurs have always been taught that the FCC was a strict disciplinarian with sweeping enforcement powers. As such, we regarded it with the utmost respect.

Gradually, over the last few decades, our image of it has faded somewhat. This has come about as we witnessed many situations in which the FCC did not react or do as we expected. This has resulted in it becoming known as a "paper tiger" in many circles.

On the surface, not knowing or understanding the position of the Commission, it would be very easy to condemn it for not doing its job. Before we do, though, let's consider a few things. Over the same period of time, the Commission's areas of responsibility have mushroomed into areas such as telephony, television, and satellites, to name a few. Being dependent on Congress for funding, its priorities are largely determined by responding to pressure from Congress.

The Hill in turn is influenced by large campaign contributors. In large numbers we could have influence, too. However, we choose not to. Therefore, you are more apt to see a cow jump over the Moon than a few letters to a gripe column goading anyone into action.

The Commission has another problem that by itself it can do little about. The First Amendment to our Constitution guarantees the right of free speech. Over 200 years ago, when it was written, the distance a human voice could be heard was measured in feet, so this was not a bad concept.

Realizing things might change in the future, our forefathers anticipated that the Constitution would need to be amended as conditions changed, so they made it amendable. This has not been done in light of present-day conditions. The result is that, in essence, we are trying to service a modern automobile with a shop repair manual for a Model T Ford. As it now stands, the courts' decisions must abide by the strict wording of the First Amendment, which says absolutely nothing about free speech with regard to communications electronically transmitted, so anything goes.

Nobody likes to lose, so it should be understandable that with little chance of winning, the Commission is not likely to waste its time and resources prosecuting violators pleading their First Amendment rights. Because anything less can be contested in the courts, a Constitutional amendment is the only way of correcting this. All that is needed is an amendment stating that the protection of the right of free speech does not extend to those accused of violating federal statutes governing electronically transmitted information.

You might ask, "Why doesn't somebody do this?" That is a very good question and it deserves a good answer or two. The first one is that no matter how badly a change is needed, a large sector of our population automatically refuses to listen to anything about it and opposes any changes to our Constitution. To them, anyone proposing such a change is talking blasphemy, being un-American, immoral, and against motherhood and apple pie as well. The second answer is that we, the public, either do not care enough or are not willing to take the time to let Congress know (whose job it is to do something) that we do care.

I have written my representative and senators several times in regard to this matter. Unfortunately, my lone voice apparently is not loud enough to impress them. Still, it does more good than to write to a gripe column—where it is not seen by them at all. It is also better than doing absolutely nothing at all. I tried. Have you? 73

QRX

continued from page 6

Taylor also credited Comal County EC Todd Covington N5IJR with taking time away from his own flood-damaged home to roll out the PrimeCo communications van and press it into flood duty service. Two repeaters in the van aided Red Cross communications.

Taylor said linked repeaters ensured wide coverage. In addition, hams in Texas made use of HF nets on 40 and 75 meters for regional coordination. In addition to helping the Red Cross, Taylor said, ham radio operators provided communication and other support for the Salvation Army, the Dallas-based Baptist Men's Kitchen feeding program, and other outside relief agencies.

Taylor himself was deeply involved in coordinating much of the flood emergency traffic throughout the affected region.

Tnx to the volunteer stars who shine big and bright and to *The ARRL Letter*, via *Chirps & Clicks and Spurious Emissions*, the joint publication of the Kalamazoo ARC and the Southwest Michigan AR Team.

Enforcer I

The FCC's new ham radio rules enforcer, Riley Hollingsworth K4ZDH, is taking a proactive role in curbing alleged rules violations. He is confronting—on the air—those whom the agency considers to be egregious offenders.

Hollingsworth showed up unexpectedly on 3.894 MHz on Wednesday, January 13th. This frequency is considered to be one of a number of hot spots that the rest of the ham community wants cooled down. Hollingsworth said he broke in on an argument that was growing increasingly nasty in an effort to calm things down. He then remained on frequency to discuss FCC enforcement with those hams who were interested.

However, not everyone wanted to hear what he had to say. According to reports on the Internet newsgroups, some operators made a serious effort to silence K4ZDH. He was jammed and some high-power stations made rude and lewd comments while Hollingsworth was on the air. Nonetheless, Hollingsworth told those involved in the 75-meter contact to keep in touch with him if they have enforcement problems, and offered a phone number and E-mail address where he

Continued on page 39

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The Card-File 40

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While backpacking with the family this past summer, the thought occurred to me more than once that the few vacant cubic inches remaining within my pack could well be occupied by some ham gear. I have seen kits for QRP CW transceivers advertised in the ham magazines, and thought one of these would be ideal. So, being the independent type, I decided to design and build my own.

After determining the size constraints of the rig, I began by selecting the chassis box for it. While I sat at my workbench sketching out schematics for this project, my eye fell upon an unused three-by-five index card file box. It was made of light-gauge steel, which would provide RF shielding, and would be able to be machined easily. Perfect! For simplicity's sake, I decided the rig was to be a single-band design for 40 meters, with a direct-conversion receiver. From this humble start, a radio was born—the Card-File 40.

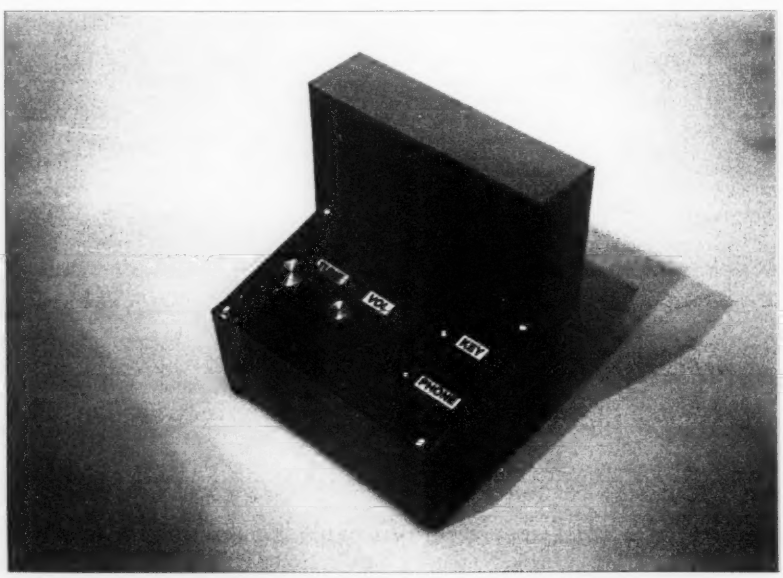

***Photo A.** The Card-File 40 in full splendor.*

Because of its simplicity, direct-conversion equipment has been a perennial favorite project for home brewers and QRP enthusiasts. I have seen dozens of designs for QRP transceivers published in the ham magazines over the years, and have built quite a few of them. Just for fun, in this project, I made a deliberate attempt not to borrow from any previously published design, so I started from scratch, breadboarding and testing each section as I went.

By the time I had built three different versions of the circuit, I finally arrived at one that did pretty much what I wanted it to do. The end result is unconventional in many parts of the design, but it derives more features from fewer parts than any other QRP rig I have seen. And it really works! The features of this transceiver include: coverage of the full 40 meter CW band, 2 watts output on transmit, VSWR-tolerant PA design, 25 mA current consumption on

receive, a high performance CW filter, a sidetone oscillator, and QSK.

But what is the price for this performance? I know first-hand what a pain home-brew projects can be. My biggest headaches? Winding coils and locating parts. Since I wanted this to be a pain-free project, I limited the circuit to three coils, and selected only generic components to use within this rig. Everything that goes into this rig can be found in standard electronics catalogs, and cost of the whole project was less than $35. Interested yet?

Take a look at the schematic, **Fig. 1**. All of the circuit functions have been labeled. Let's take an overview of the circuit to help understand how it works.

The heart of a direct-conversion transceiver is its VFO. In the transmit mode, the VFO signal is amplified and coupled to the antenna. In the receive mode, the VFO signal drives the mixer to demodulate the antenna signal. In the schematic of the transceiver, the VFO is in the upper left corner. Is that all there is, you may ask? Where are the JFET, the buffer transistors, the output-matching transformer, and the biasing components one expects to find in a VFO? All of these functions are performed in this circuit, a Hartley oscillator using one gate of U1, a 74HC86 quad-XOR gate, as the amplifier. The logic gate has low input capacitance, high gain, and high output drive capacity, so it works quite well in a VFO circuit, with far fewer parts than the usual designs.

While I initially considered using a variable capacitor to tune the VFO, it occurred to me that most hams are not going to have a small-value variable capacitor and a vernier reduction drive in their junk boxes. So, scratch that idea! What I ended up with was a VFO that is actually a VCO—voltage-controlled oscillator. While there are some transceiver kits that use voltage-controlled-capacitance diodes (varactors) to tune their VFOs, I opted for a simpler and more economical approach—using the voltage-variable drain-source capacitance of Q3, a 2N7000 MOSFET, to tune the oscillator. The voltage on the drain of this device is controlled by a ten-turn, panel-mount pot, a device available though Mouser and Digi-Key, among others. This circuit covers the entire CW portion of 40 meters, at roughly 15 kHz per revolution of the tuning pot—a tame enough ratio for a CW receiver. For improved stability, the VCO components are shielded in a

Continued on page 12

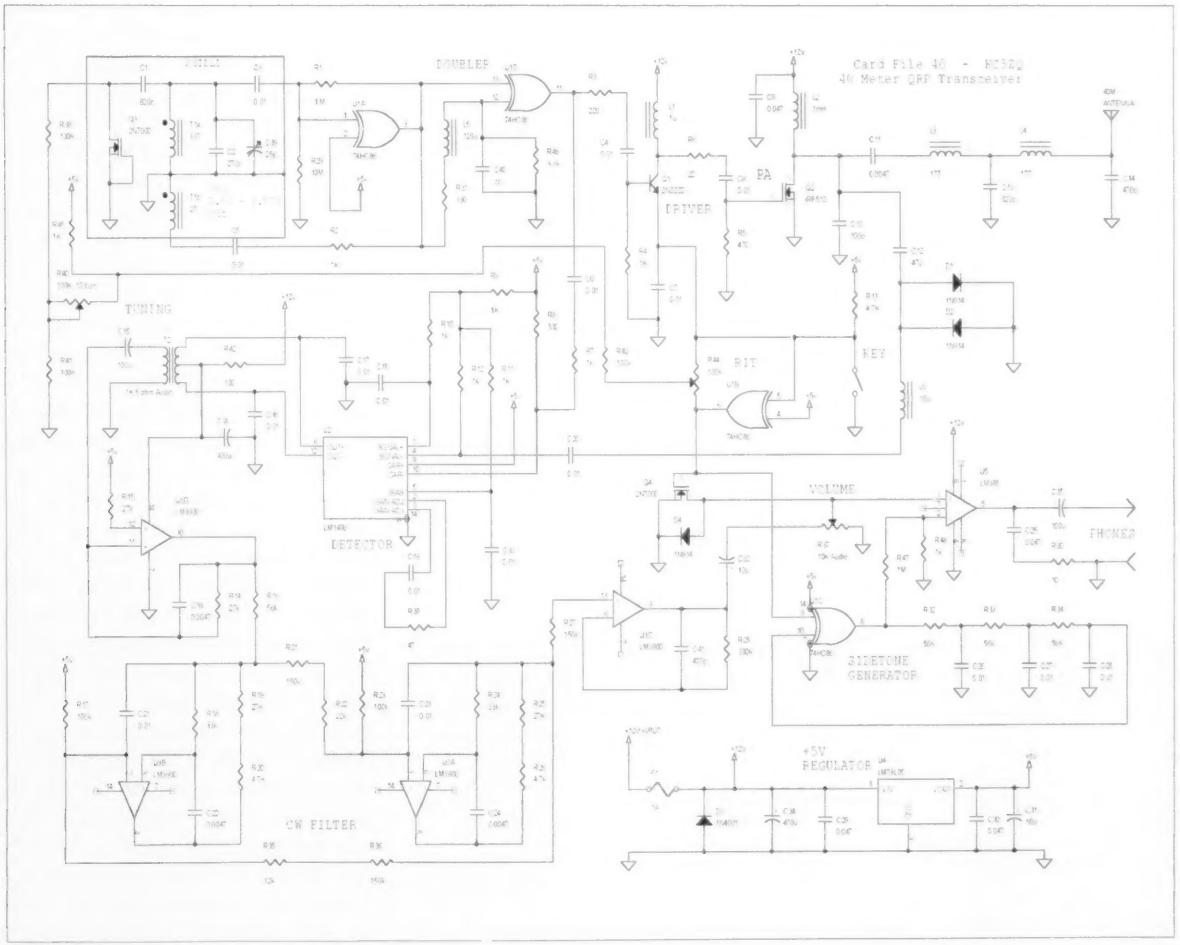

Fig. 1. *Schematic for the Card-File 40.*

PARTS LIST			
R1, 47	1 M	**R28**	390 k
R2, 5	470	**R29**	10 M
R3	220	**R30**	10
R4, 7, 9–12, 45, 48	1 k	**R39**	47
R6	22	**R16, 32–34**	56 k
R8, 31	330	**R35**	12 k
R13, 20, 26	4.7 k	**R37**	10 k audio taper pot (vol.)
R14, 15, 19, 25	27 k	**R40**	100 k 10-turn panel-mount pot (tuning)
R17, 23, 38, 41, 43	100 k	**R42**	100
R18, 24	33 k	**R44**	100 k miniature trimpot (RIT)
R21, 27, 36	150 k	**R46**	3.3 k
R22	22 k	All resistors 1/4 W 5% or better, unless otherwise noted.	
C1, 13	820 pF 5% silver mica or NPO	**C15, 35, 38**	100 µF 16 V electrolytic
C2, 41	270 pF 5% NPO	**C21, 23**	0.01 µF 5% poly
C3–9, 17–20, 26–28, 33, 36, 37	0.01 µF ceramic	**C25, 29, 30**	0.047 µF ceramic
C10	100 pF 5% silver mica or NPO	**C31, 32**	10 µF 16 V electrolytic
C11, 16, 22, 24	0.0047 µF 5% poly	**C34**	470 µF 16 V electrolytic
C12	47 pF ceramic	**C39**	25 pF trimmer
C14	470 pF 5% silver mica or NPO	**C40**	3 pF NPO
Q1	2N2222	**Q2**	IRF510 or IRF511
Q3, 4	2N7000		
D1, 2, 4	1N914 or 1N4148	**D3**	1N4001 or equivalent
U1	74HC86 quad XOR gate — DO NOT substitute 74HCT86		
U2	LM1496 double-balanced mixer	**U4**	78L05 5 volt regulator
U3	LM3900 quad Norton amp	**U5**	LM386 audio amp
T1	Primary: 33T 26 AWG. Sec.: 2T 22 AWG on T-50-2 core	**T2**	1 k CT 8 ohm audio transformer
L1	1 µH axial RF choke or 15T 22 AWG on T-50-2 core	**L4**	1.4 µH 17T 22 AWG on T-50-2 core
L2	1 mH 200 mA axial RF choke	**L5**	120 µH axial RF choke
L3	1.6 µH 18T 22 AWG on T-50-2 core	**L6**	10 µH axial RF choke
F1	1 A fast-blow in line with power cord		

The Card-File 40

continued from page 11

small enclosure made of copperclad PC board material.

Using a VCO in this manner makes addition of an RIT a simple matter. A sample of the keyer voltage is added into the VCO control voltage to shift its frequency during transmitter keying, so that a received, demodulated signal on the same frequency as the transmitter frequency will fall within the 700 Hz CW filter.

Notice that the output of the VCO is indicated in the schematic as 3.500 to 3.575 MHz, half that of the transceiver operating frequency. The VCO frequency cannot be the same as the transmitter frequency, or else during transmit, energy from the RF power amplifier circuitry will enter the VCO, causing its frequency to be pulled. So, we generate our VCO signal at half the transceiver frequency, and use a frequency-doubler circuit to keep the VCO well-behaved. This doubler circuit consists of XOR gate U1D and phase-shift network L5, C40, and R46.

The output of the VFO doubler U1D is coupled to the pre-driver amplifier Q1, a 2N2222 transistor, which in turn drives Q2, the power amplifier transistor, an IRF510 MOSFET. To reduce the final amplifier drive requirements, the inductor in the collector circuit of Q1 is resonated against the gate capacitance of Q2. The output of the PA is low-pass-filtered by a broadband pi-L network, and delivers 2 watts into 50 ohms, with the second harmonic down 40 dB. The efficiency of this power amplifier is superb, at least 80%, so no heat-sinking of the PA transistor is necessary. Another nice feature of this design is that the PA transistor does not self-destruct if the transmitter is keyed with no antenna attached. No one likes to have to do field repairs!

Turning now to the receiver side of the Card-File 40, I have seen a number of different devices used for the demodulator of direct-conversion receivers, including diode-ring mixers, dual-gate MOSFETs, NE602 or CA3028 ICs. I chose here to use an LM1496 mixer IC simply because it is the least expensive and most commonly available

device of the group. It has the advantage of possessing conversion gain, which acts as the equivalent of one stage of RF amplification. Additionally, the LM1496 has better dynamic range than an NE602, and better rejection of in-band AM signals than a dual-gate MOSFET. The VCO doubler drives the carrier input of the LM1496, and a sample of the antenna voltage drives its signal input.

One portion of this design that has been used in many other QRP transceivers is the transmit/receive switching circuit, which couples the antenna signal through C12 into the signal input of the LM1496. Shunt diodes D1 and D2 connect between C12 and ground. During transmit, the high amplitude of voltage applied to C12 will be clamped by these diodes prior to reaching U2, preventing this IC from being damaged by overvoltage at the signal input. When no large signals are present at the antenna during receive, these diodes possess a high impedance, allowing antenna energy to reach the LM1496.

The output of the LM1496 is coupled through audio transformer T2, and is amplified by one section of U3, an LM3900 op amp. Those familiar with this part will recognize it as a Norton op amp, which is a device providing current gain, as opposed to conventional op amps, which provide voltage gain. The Norton op amp possesses low-impedance inputs, referenced to ground. This, plus the very low power consumption of the part, make it well suited for operation from a single 12 volt battery supply.

Filtering of the CW signal is performed by sections A and B of the LM3900. This circuit is a 200 Hz wide, Blinchokoff bandpass filter centered at 700 Hz (see my *73* article "HIPER Audio Filter," May 1994), possessing very low overshoot and ringing for best intelligibility of the CW signal. Use of this particular active circuit topology allows this filter to be constructed without requiring high-precision components. Those familiar with use of a direct-conversion receiver will appreciate the extra attention to the CW filtering. Admittedly, compared

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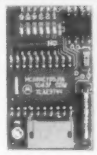

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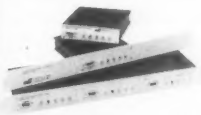

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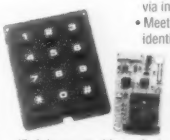

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to a single-sideband, superheterodyne rig, a direct-conversion receiver is at somewhat of a disadvantage due to its lack of single-signal reception, which increases the received QRM and QRN. Addition of a high performance filter such as this goes a long way to making this a usable transceiver. In this circuit, the virtues of the Norton op amp are especially apparent. If conventional op amps were used instead, two additional op amps and six extra resistors would be required to perform the same filtering function.

Section C of the LM3900 buffers and amplifies the output of the CW filter where the output of this amplifier stage is clipped by diode D4 and the body diode of Q4 to limit noise from transmit/receive transients, atmospherics, etc. The signal from U3C enters volume-control resistor R37 on its way to U5, an LM386 audio driver IC. This provides output for a pair of 8-ohm headphones. Transistor Q4, a 2N7000 MOSFET, also serves as a receiver mute. The gate of this MOSFET is tied to the keying voltage from U1B, which causes this transistor to shunt the receiver signal from the input of the U5 to ground when the key is down. For a sidetone monitor, section D of U1 is set up as a 700 Hz phase-shift oscillator, which is coupled into the audio amplifier though R47.

Overall, the receiver possesses on the order of 110 dB gain from antenna to headphones, and if proper board layout is followed, there is no tendency for oscillations or microphonics in the audio.

A nominal power supply of 12.6 volts is required to operate this transceiver. Diode D1 and a one-amp fuse protect the circuit against accidental reverse-voltage connections. A 78L05 regulator provides a stable five volts for the VCO circuit, preventing drift or chirp of the CW signal.

The radio-frequency coils used in this rig are fairly simple to build—they are all wound on Amidon T-50-2 iron-powder toroidal cores, with enameled copper wire used for the windings. Remember that turns are counted as the number of times the wire passes through the center of the core. Pay attention also to the winding direction of the secondary of the VCO coil. If it is the wrong direction, the VCO will not oscillate!

I built up the circuitry on a three-by-five-inch piece of copperclad PC-board material, cut to fit inside the card-file box. Components were mounted using the "dead-bug" construction method, using the PC board as a ground plane. Keeping the construction simple, the circuit board was mounted on the base of the box with standoffs. I soldered brass 6-32 nuts inside the upper corners of the box to mount the front panel. Holes in the back were drilled to accommodate the antenna coax connector and 12 volt power plug. The front panel was cut out of a piece of copperclad PC board material, with holes drilled for the tuning and volume controls, the headphone and key jacks, and the mounting screws. Mount the front panel copperside down for best grounding. Using a card-file box like this protects the knobs and jacks under the lid of the box when it is closed and not in use. Also, there is enough room under the lid to store a pair of ear-bud style headphones, a small straight-key, or maybe a pad of paper for logging while you are operating in the wilderness.

Final alignment of the transceiver requires a frequency counter or calibrated receiver. First, it is necessary to ascertain that the doubled-VCO frequency covers the desired frequency range, from one end to the other of the tuning control—7.000 to 7.150 MHz. Trimcap C39 is used to shift the frequency range. If the frequency range cannot be brought into range using C39, it is possible to add or subtract a turn from the toroid T1 to alter its inductance as needed.

The RIT control R44 must be adjusted so that the VCO frequency shifts by 700 Hz between transmit and receive modes. With a 50 ohm dummy load on the antenna connector, key the transmitter, and observe the frequency shift. If calibrating using a receiver without fine resolution on its readout, we can set the RIT by setting the calibration receiver tuning to zero-beat against the VCO frequency. On key-down of the transceiver, its VCO frequency should be heard in the calibration receiver as a

700 Hz audio tone—roughly F above middle C if you have access to a piano, or the same pitch as the sidetone oscillator in the transceiver. Set R44 as necessary and repeat until the RIT offset is where is needs to be.

For the Extra Class hams, the lack of dial calibration is not a problem—you just operate where you hear other CW operators working. But for those who are limited in the frequencies they can use, and need to keep track of their frequency, it is a good idea to add a turns-counter knob. These are available from Mouser and Digi-Key. You can then calibrate the VFO against another receiver, and put together a conversion chart to determine the actual frequency of the rig versus the position of the tuning control knob. This chart may be mounted on the inside lid of the chassis box.

After the final tweaking has been performed, paint the VCO coil with clear fingernail polish or Q-dope to hold the turns in place, and reduce its susceptibility to microphonics.

How does it operate? Not too bad! On the receiver side, this rig is hot enough to hear anything I can pick up with my "real" ham equipment. The CW filter really cuts the noise without distorting the signal, so the audio is comfortable to listen to. With a well-regulated power supply, the transmitted signal was found to be clean and chirpfree. My first contact using this rig was with a W4 in Florida; my second QSO was with a CL2 in Cuba! It sure is a pleasure to receive T-9s on a home-brew rig!

There is plenty of room left within the card-file box for other options to customize your Card-File 40. You could add ten NiCd AA cells to make the rig truly portable. You could add a simple keyer circuit, perhaps a crystal oscillator calibration circuit, or any of many other many possibilities. Or, if you are like me, you will have so much fun with this little rig that you won't want to take it off the air long enough to modify it. Enjoy this project—I sure did—and I'll look for you on 40 meters!

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The EZ-BZ gets me good signal reports on SSB with my Ten-Tec Argosy at 50 watts and also with my 12-watt monobander, an MFJ Model 9420. Some DX stations are surprised to learn that I'm using modest power and a home-brew loaded dipole—from my deck!

Design and construction

About a year ago, I set out to design and build a compact 20-meter dipole that could be easily erected on my deck and quickly dismantled at day's end. Ideally, its performance on 20 meters wouldn't be too different from that of my half-size G5RV. The result of my efforts is the EZ-BZ deck antenna, named for its easy *(EZ)* assembly and its two main components, *B*amboo stakes and Zip cord (not to mention my call!). Long a favorite for home-brew antenna projects, bamboo combines rigidity and light weight, and is readily available at garden supply stores. Two six-foot bamboo stakes support the wire radiator: ordinary 18-gauge zip cord. Zip cord was chosen because it is insulated and very flexible.

At the outset, I knew that some form of loading would be required. I opted for linear loading because it is considered to be less "lossy" than a loading coil. In the EZ-BZ, the linear loading consists of three lengthwise runs of zip cord along each six-foot bamboo stake (**Fig. 1**). To make the antenna resonant at 14 MHz, an additional six feet (approximately) of zip cord are required. The six feet of zip cord simply droop from the end of each stake, making the EZ-BZ a bent dipole. The bent dipole design keeps the horizontal span to a minimum (11 feet), yet does not cause very much signal loss.

The zip cord is fed directly by RG-58 coaxial cable, without a balun. The coax is connected to the zip cord via two screws in the conduit portion of the antenna mount (**Fig. 2**). The other prominent feature of the antenna mount is a PVC T. The T holds the two stakes securely, yet permits the antenna to be assembled or dismantled in just a few minutes.

Fig. 1. Linear loading of the zip cord on a bamboo stake (not to scale). See text for details.

Assembling the antenna mount

The parts required for the EZ-BZ are

listed in **Table 1.** The antenna mount consists of a heavy-duty 1-1/4-inch PVC T attached to a length of 1-1/4-inch PVC electrical conduit (**Fig. 2**). I used a one-foot length of conduit, but for some installations a longer conduit might be more appropriate. The first step in constructing the antenna mount is drilling two 5/32-inch holes in the conduit to accommodate the screws. The screw holes should be one-half inch below the junction of the conduit and the T. A one-quarter-inch hole, drilled five inches below the screw holes, permits the coax to exit the conduit.

The PVC T supports the two bamboo stakes by their own levered weight against the inner edges of the T (**Fig. 2**). The angle between the two stakes is about 150°, making the EZ-BZ a—slightly—inverted V. As an option, you can increase that angle to about 165° by reducing the interior diameter of the PVC T. Simply insert a one-inch length of the PVC conduit into each end of the T until the ends of the inserts are flush with the ends of the T.

Selecting and weatherproofing the bamboo stakes

The pair of bamboo stakes used for the antenna should be fairly straight and have about the same diameter. Weatherproofing is done with a wrap of black vinyl electrical tape. The tape is wrapped from the tapered end of the stake toward the wide end, with an overlap of about half the tape width on successive turns.

Attaching the zip cord to the stakes

In the finished product, the zip cord is secured to the wrapped bamboo stakes with cable ties. Since the snugged-up cable ties cannot be loosened, the zip cord is initially affixed with twist ties. Begin the process by completely separating the two conductors in 23 feet of zip cord and attaching a split ring connector to one end of each. The split ring connectors will be at the feedpoint.

Fig. 1 shows the pattern of the linear loading on a bamboo stake. The pattern of the runs on the two stakes should be mirror images, since the two halves of a dipole should be mirror

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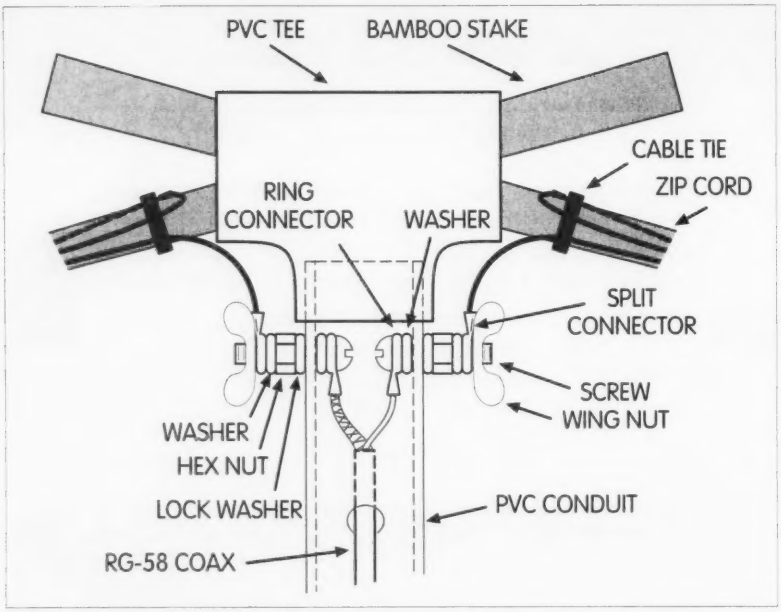

Fig. 2. Construction details of the antenna mount, showing the PVC T, which supports the bamboo stakes, and the connections of coax to zip cord via screws in the PVC conduit.

images of each other. Start the first lengthwise run by attaching the zip cord, three inches from the split ring connector, to a wrapped bamboo stake, seven inches from the wide end. Secure the zip cord with twist ties every seven inches (or closer), with the last tie being two inches from the tapered end. After the third (final) run, add a twist tie one-half inch from the tapered end so that the "tail" will droop from the tip.

Approximately six-and-a-half feet of zip cord will initially hang free from the end of each stake. The exact length doesn't matter at this stage, but it should be the same on the two stakes. If not, adjust the lengths of the runs so that the overhangs are the same.

Finally, replace the twist ties with cable ties. At the turns, secure the cable ties over both wires. Check that the adjacent runs of zip cord are evenly spaced around the circumference of the stake and that they do not touch each other.

Assembling and erecting the antenna

To assemble the antenna, insert the wide ends of the bamboo stakes into opposite ends of the T until about an inch of each stake protrudes from the other side. After you secure the split ring connectors with the wing nuts, the antenna can be erected.

The required mast height will depend on the height of the deck. For my deck, a 10-foot mast seems adequate because the deck floor is nine feet above the ground. I use two five-foot lengths of one-and-one-quarter-inch PVC electrical conduit, which is the same conduit used for the antenna mount. Electrical conduit is sold in 10-foot lengths, with one end flared. I strap one five-foot section to a deck post and insert the other five-foot section into the flared opening of the bottom section. A PVC connector secures the antenna mount to the top of the mast. To rotate the antenna, I simply turn the mast by hand.

CAUTION: The ends of a dipole have high RF voltages, which can cause burns. The antenna should be erected high enough or the deck cordoned off that the ends cannot come into contact with people or animals. For RF safety, the power output should be limited—and antennas should never be erected near power lines.

Adjusting antenna length

The electrical length of the EZ-BZ is adjusted after the antenna has been erected on a mast at its final location. For a deck installation, the EZ-BZ should initially be positioned so that the axis of the antenna is perpendicular to the side of the house. This orientation generally gives the lowest SWR readings.

When adjusting the length of the zip cord, trim both drooping ends about one-half inch at a time until the SWR is at a minimum at the desired frequency. Initially, my 20-meter EZ-BZ had an overhang of six feet, six inches, and was resonant at 13.7 MHz (1:1 SWR). Trimming eight inches from each drooping end (final length: five feet, 10 inches) increased the resonant frequency to 14.15 MHz (1:1 SWR). The SWR curve is shown in **Fig. 3**. Since the SWR does not exceed 1.7:1 across the entire 20-meter band, I am comfortable using the EZ-BZ without an antenna tuner. All SWR measurements were made with an Autek RF Analyst, Model RF-1.

Parts List

Qty.	Description
23 ft.	black 18-gauge zip cord
6	6-foot bamboo stakes
2	round head 8-32 3/4-inch brass screws
2	brass hex nuts
2	brass wing nuts
4	brass washers
2	bronze lockwashers
2	ring connectors
2	split ring connectors
Black vinyl electrical tape, 3/4-inch or 1-inch wide	
4-3/8-inch-long (across top) heavy-duty PVC tee, 1-1/4-inch diameter	
Schedule 40 PVC electrical conduit (gray), 1-1/4-inch diameter	
RG-58 coaxial cable	
Cable ties	
Twist ties	

***Table 1.** Parts list.*

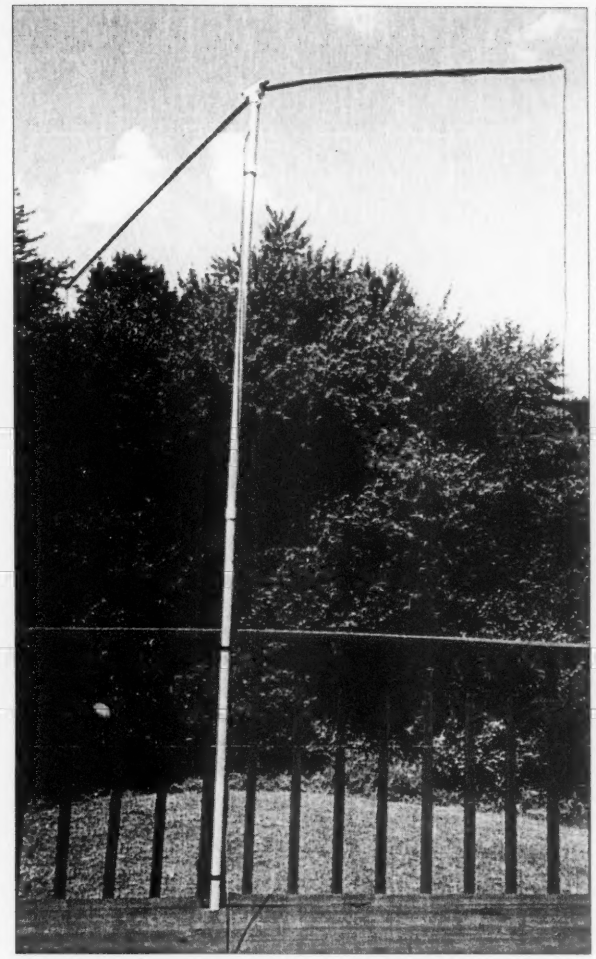

Photo A. *The 20-meter EZ-BZ antenna erected on the author's deck.*

band, just switch the bamboo stakes, which takes only few minutes.

Performance

I have used the 20-meter EZ-BZ for nearly a year with considerable success. Using the Argosy at 50 watts, I have compared its performance to that of my half-size G5RV. The EZ-BZ was erected 20 feet above the ground and rotated to the same orientation as the G5RV, which is 35 feet above the ground. The comparisons were made the old-fashioned way—by switching antennas during QSOs with very patient hams. In a QSO with Andy VE3ORE, located 200 miles north of Toronto, the signal report was S7 for both antennas. Likewise, Dick K9FA in Wisconsin could detect no difference in signal strength, with both antennas scoring S8. An interesting comparison was made during a QSO with two hams, John VE6AIV in Alberta (Canada) and Larry W4ERN in Florida. John gave the edge to the EZ-BZ (S6 vs. S5), while Larry gave it to the G5RV (S7 vs. S6). In all of the comparisons, I could detect no obvious differences in signal strength on receive. Rotating the EZ-BZ occasionally results in a change in signal strength, but rarely is the difference dramatic.

The basic design of the EZ-BZ can be adapted for use on other HF bands. Trimming the tails to about 21 inches creates a 17-meter EZ-BZ. For a 10-meter EZ-BZ, no linear loading is required. Each bamboo stake supports about eight feet, one inch of zip cord: five feet, eight inches are attached to the six-foot stake and the remaining two feet, five inches droop from the tapered end. To work more than one

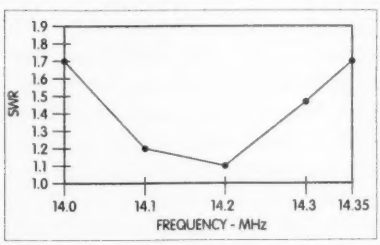

Fig. 3. *The 20-meter SWR curve.*

In conclusion, the EZ-BZ has definitely met my requirements for a compact, easy-to-assemble antenna with respectable performance. It may be just the ticket for those who would like to "clear the deck" and make way for a different style of hamming! 73

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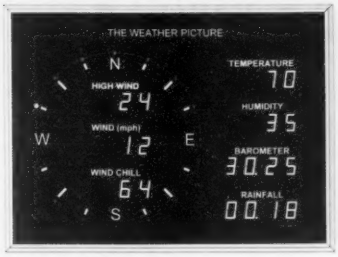

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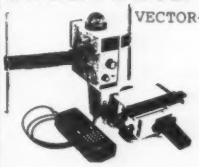

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CIRCLE 58 ON READER SERVICE CARD

Our Exciting New Fox

How one club settled on the Hamtronics T301.

Larry Antonuk WB9RRT
P.O. Box 452
Marlborough NH 03455

The storms of winter were just a memory, and the first signs of spring were showing through. In some areas, the thoughts of young men turned to love. In our neck of the woods, however, it was obviously time to start planning the early summer foxhunts!

Wanted: a new fox

Our last year of foxhunting had been fairly successful. Still, the club had found itself in a couple of embarrassing predicaments. Once, the small handheld we were using as the fox blew its RF power amplifier transistor. This happened midway through the hunt, so by the time anyone figured out what was wrong, it was too late to restart. Another time, we had some miscommunication concerning the actual hunt frequency. Normally this wouldn't have been a problem, but we had a few hunters with rock-bound receivers. At that time we were using an older rock-bound mobile rig, so neither the fox nor the hunters were able to QSY. These guys wound up hunting with other groups, but there was a fair amount of grumbling that could have been averted by a frequency-agile fox.

So what do we need?

We set a few minutes aside during our last club meeting to hash over the situation. As we discussed the requirements for the next club purchase, several points became clear. We needed only a few watts of output power for the type of hunts in which we were interested. We needed frequency programming ability, but it didn't need to be fancy.

(As a matter of fact, we remembered one hunt in which the frequency control had been bumped one notch as the fox was being hidden. This wasn't noticed right off, but by the time we got back to the starting point, the signal was noticeably raspy. This just added more challenge to that hunt, but someone remarked that it shouldn't be too easy to change channels!)

The reprogramming would only take place once or twice a month at most. We were also interested in a means of reprogramming that was easy to interface to. We had some special hunts where the fox hider would try some special tricks, such as switching between two freqs during the hunt, or varying the frequency plus or minus twenty kHz at various points in the hunt. This made the hunt more "lifelike." This was the downside of our hobby—we found ourselves practicing for jamming situations more often than enjoying plain old competitive hunts.

We also wanted true continuous-duty operation. In case the controller went crazy and stayed in PTT, we didn't want the transmitter to melt down. We also wanted a transmitter we could use during club demos and training sessions—not continuously, but to key-down for a couple of minutes at a time without getting nervous about it. Finally, we wanted something we could fix ourselves, and that had good factory support if we needed it.

Steep requirements

This seemed like a fairly steep set of requirements, but by the time someone mentioned continuous-duty operation, a few club members had already pulled catalogs from their pocket. The fact that they were all Hamtronics catalogs was neither a coincidence nor a conspiracy.

Our club had used several Hamtronics products in the past—their dedicated receivers and transmitters were currently in our repeater, RF links, and a couple of APRS applications. The group was familiar with the quality available as well as the customer support. The question was no longer "which vendor" but just "what transmitter." As it turned out, this decision was predetermined as well. Hamtronics had a unit that fit our requirements perfectly.

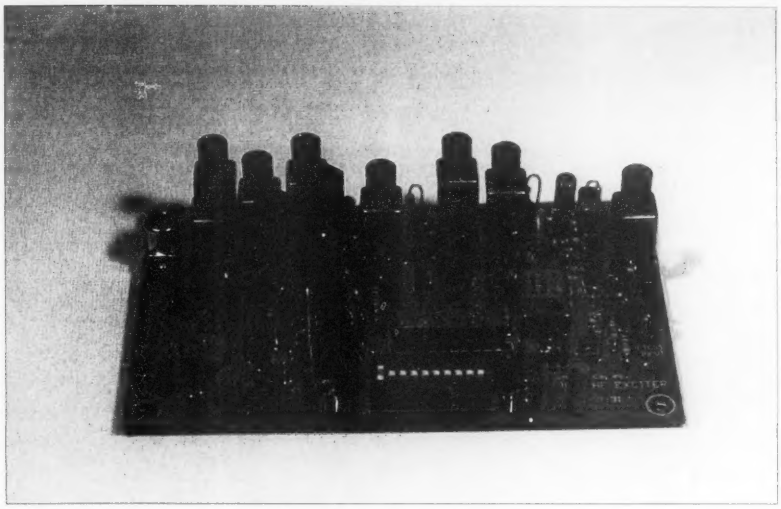

Photo A. *The Hamtronics T301 board.*

A foregone conclusion

Opening up the catalog, one of the members pointed out the T301 VHF FM Exciter. Two to three watts output. Continuous-duty operation. Separate audio and CTCSS inputs. Special low-noise synthesizer. Frequency accuracy of 2 ppm available, and standard on the assembled version. And it was direct FM-modulated, and could accept data rates of up to 9600 baud.

The only argument concerned whether to buy it assembled or in kit form. Some of the members felt that building it up ourselves would give us a better understanding of the transmitter, which would be helpful in future modifications. Others pointed out that the Hamtronics documentation is clear enough to get us through any future mods, and that we should get our hands on the thing as soon as possible. As it turned out, the TXCO option tipped the scale. It was pointed out that the high-stability temperature-controlled oscillator was an option for the kit, but was included with the pre-assembled module. This made the cost differential just $40 between the assembled unit and the kit with the TXCO option. This seemed like a small price to pay to be up and running as soon as we took the T301 out of the box. (Since the T301/R301 series of modules no longer uses crystals for frequency selection, Hamtronics can now provide next-day service—there's no need for custom crystals to be ground.)

Checking it out

We ordered the T301 and received it just a couple of days later. As usual, the group met at someone's shack to check it out. On first glance, the exciter looked just like what we'd expect from the Hamtronics line. The rig was built on a high-quality double-sided PC board, with an ample ground plane. High-quality parts were used throughout, including a twenty-pin surface mount device on the bottom side of the board. Our resident repairman liked the use of sockets for the ICs, a large heat sink on the PA transistor, and the use of well-marked connection points. Our resident hacker, on the other hand, was more interested in getting access to the circuitry. He liked the frequency-programming DIP switch, which gave easy access to the frequency select lines of the VCO—either for a set of switches or a microcontroller. He also seemed interested in the fact that the exciter output can be varied from two to over three watts by varying the supply voltage between 13.6 and 10 volts DC (something about a variable power output being handy in one of the "no holds barred" hunts ...).

Applying power

We soldered a few wires to the board, and were up and running in just a few minutes. Hooking up the controller (a Basic Stamp) proved to be only a slight challenge. Since the T301 is designed primarily for repeater service, it doesn't have a separate PTT line. The unit is in transmit any time power is applied. We simply provided a transistor switch to supply B+ to the exciter, operated by the controller. We did notice that there is a provision to keep the synthesizer running at all times, and to cycle B+ to the RF stages only. This is because there is a slight delay as the onboard microcontroller boots up and initializes the synthesizer, and there might be a small loss of voice or data during this time in a repeater installation. The solution to this is to keep the synthesizer powered continuously (about 30 mA) and key the transmitter as needed via the B+ (about 550 mA). In our case, we didn't need lightning-quick key-up, so we simply cycled power to the entire board and made sure the controller assumed a half-second or so key-up time before it sent any Morse Code.

The Hamtronics T301 checked out quite well on the bench, and we hope to be chasing it as soon as the last of the snow clears away. Last seen, the rig was being sized to fit into the base of a clay flower pot, with a dipole draped through the branches of a dead shrub that was mounted right in the pot. (Hmmm. Not sure if I was supposed to let that out of the bag or not ...)

The Hamtronics T301 comes in several models, with band splits that cover most ham and commercial bands. It is available from Hamtronics, Inc., 65-D Moul Road, Hilton NY 14468-9535. Phone: (716) 392-9430. E-mail: [jv@hamtronics.com]. A complete catalog also is available on their Web site [www.hamtronics.com]. 73

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There are far more economical ways to prepare these culinary delights, but alas, there are few inexpensive alternatives to the dummy load for off-the-air testing of today's powerhouse amps. Consequently, big ticket and key-down carriers abound on all the frequencies—to the consternation of the rag-chewers and net controllers.

By default, the antenna provides the only easily accessible cheap place to dump large doses of RF during tuneups. But just because many amateurs do it, that doesn't make it right! Admittedly, yours truly was briefly a member of that group, but I was not at any time during that period pleased with what I had to do to test my amplifier decks. Because of my uneasiness, I began to consider some of the alternatives to QRMing the world.

Here's one idea that you might think worthwhile. It's based on the adage that *one man's feast is another man's famine*. Although I hate the use of this cliché, it is true and relevant in this project. If you'd like to see how this relationship correlates to building a dummy load from Heath Cantenna discards, read on—I promise that you will be pleasantly surprised.

Yes, there is a better (and less expensive) way!

The consensus of radio amateurs regarding on-the-air testing is unanimous in favor of its elimination. However, it's not realistic to expect the average brasspounder to lay out big bucks to buy a commercially built water-cooled dummy load. It's simply not a cost-effective purchase. Besides, the conventional thinking is that if you tune up on the air, you're only on for a brief time. In the worst case, you're only disturbing a couple of people.

The bottom line is that on-the-air testing remains the cheapest game in town and, more important, you'll get away with it simply because no one will know that it's you causing the interference. Fortunately for the majority of us, most hams are more highly principled, and always on the alert for a better way to test their finals. I'm convinced that a sensible, rationally priced, easily duplicated alternative will get the boys on the ham bands to clean up their act in a heartbeat.

No one knows how many Heath Cantenna dummy loads are out there languishing under benches simply because they can no longer cut the mustard. The high output of the modern amplifier, developed as a result of the FCC's new definition of "legal limit," resulted in the Cantenna's demise. This old friend can no longer handle the new power levels safely.

To prove the point that the Heath units are in disfavor, walk the hamfests and check out the large numbers of Cantenna discards, the dummy load heroes of yesterday, with $5–$15 price tags on them. With that availability and cost factor in mind, think about this scenario for a moment: What if you were able to connect up a bunch of these Heath has-beens safely in order to accommodate a higher absorption level of RF power, for a fraction of the

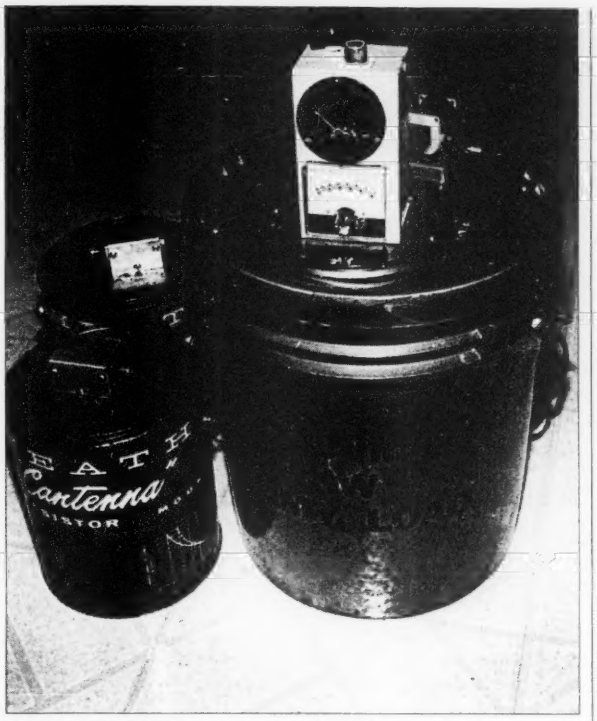

Photo A. *The 3 kW dummy load all dressed up and ready to go. The optional circuit with the RF (top) and the relative output meters have replaced the Heath minibox on the lid of the gallon container. The meter chassis was mounted vertically so that the rear panel could be removed for convenient access to the circuitry. The sensitivity control and the SO-239 are located on the top of the enclosure. The open-frame 115 VAC gearhead motor, driving the paint stirrer at 200 rpm, is located to the rear. The two forlorn Heath discards have, in a sense, donated their vital organs to give their big sister a new lease on life.*

cost of a commercial dummy load? Would you give it a try? The answer is obvious!

It can and has been done (see **Photo A**). If you decide that this is a viable project, buy as many Cantennas as you can (for a total of four). But while negotiating and attempting a meeting of the minds with the seller (haggling), don't divulge the reason for the purchase. You'll want to keep the price low. Keep in mind that the first principle of economics dictates that the demand for an item and its price are directly related.

Here's where some acting skills can help. Be as nonchalant as possible when making your best deal and avoid tipping your hand about what's up your sleeve. As a matter of fact, continually question rhetorically (and vociferously in the Shakespearean tradition) the sanity of your purchase and repeat, as often as necessary, that you are probably making the mistake of your life. Crocodile tears at this point would be a plus. Remember, the tailgaters are a slick bunch, and if there's any hint of your true motivation for the purchase, I can assure you it will be reflected instantaneously (you know which way) in the price.

By the way, bring a pocket VOM with you to check for continuity and resistance. Don't be alarmed if the meter reads an open circuit. Heath used a robust 50-ohm noninductive resistor but made the internal connections with some rather thin-gauge silver-plated copper. It's probably the flat stock rather than the resistor that's bad. Use this fact to drive the price even lower and to demonstrate further that your sanity remains in serious question. What you want to do in this charade is to point out that it's foolish to purchase ham equipment that's defective. Remember, it's all done in fun and a successfully wrought deal enhances the hamfest experience for both parties.

Those who don't enjoy this style of bazaar negotiating may then direct their energies to other pursuits and advertise their Cantenna needs on the Internet, BBS bulletin boards, or reflectors. I've been down that route, and the number of responses will surprise you. Shipping is not really a problem. In order to make certain that the mineral oil (it's harmless) doesn't leak out,

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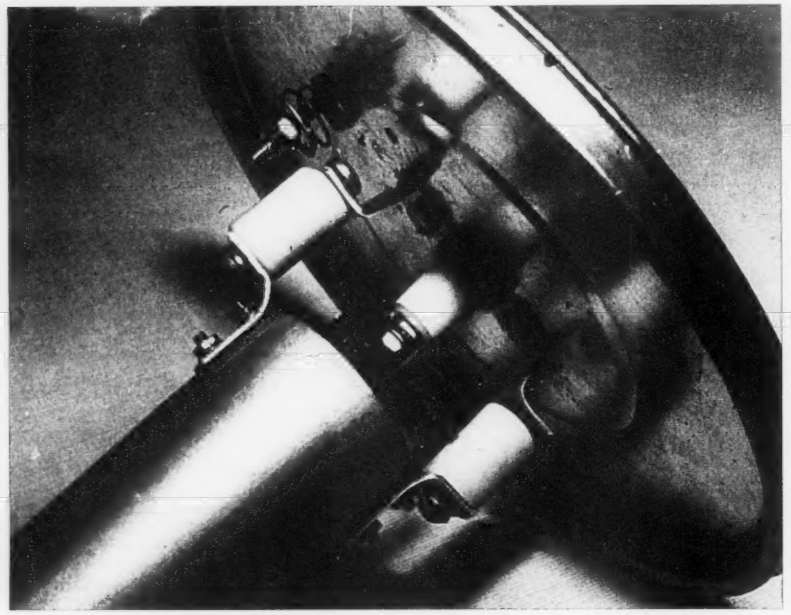

Photo B. *A close-up view of the resistor support structure. Note that the two threaded insulators are blocking the return path to ground. The two aluminum supports have been cut, drilled, and bent to shape to accept the insulators. If you are unable to locate the insulators, snip off about half an inch of aluminum and replace that length of material with a strip of Plexiglas™. The porcelain feedthrough insulator transfers power from the source to the base of the resistor. Note how the U-shaped bracket, connected to the base of the resistor and centered in the aluminum tube, is bolted to the feedthrough. The spring-loaded bolt assembly above the insulator is the original pressure relief valve in the event of boilover.*

remind the seller to securely tighten the lid and place several lengths of duct tape around the perimeter of the can as well as over the spring-loaded safety vent. Wrap the gallon container in a heavy-gauge plastic bag, and provide enough cushioning in the shipping carton to prevent damage. For whatever it's worth, mark the carton *THIS SIDE UP!* The alternative is to empty the mineral oil into a separate plastic container. The shipping charges will be the same, but the carton will be slightly larger.

What's next?

After you've accumulated your Heath Cantenna stockpile, disassemble the units by prying off the lids. Make certain you have several layers of newspaper on the floor to absorb the mineral oil drippings. Allow the resistor assemblies to drain. Pour the oil from the individual Heath gallons into an empty plastic five-gallon pail that's been scrubbed clean. The container best suited for our needs once held gypsum board taping compound, but a five-gallon pail from paint or laundry detergent is OK. If you're a home handyman, you've got them around. If not, check out a new home construction site when the painters are just about finishing up and help yourself (with permission) to one of the many in the pile. Make certain you get a lid that fits securely and has a large flat surface for mounting the components.

Before you dump in the oil, fit a piece of metal screening to the inside top, sides, and bottom of the pail. I was fortunate to have some remnant aluminum decorative radiator enclosure mesh for the project, but a small length of aluminum or copper mosquito screening works equally well. It's available off the roll at your local hardware store or home center. Through-staple the screening where it overlaps itself in order to provide support, to maintain its shape, and to confine the RF. You'll want to keep the radiation within the pail in order to comply with both the spirit and the letter of the new FCC regulations that limit the levels of permissible exposure around the shack.

You may be wondering why "4" is the magic Cantenna number. First, it's impossible to find a single megapower, noninductive 50-ohm resistor. The alternative is to use our knowledge of the properties of resistance in electronic circuits to attain the power levels we need at the correct input value.

So, four series/parallel 50-ohm Cantenna resistors coupled with five gallons of a circulating cooling medium (more on that later) solve the problem. Remember, two resistors of equal value in parallel reduce their resistivity by one half, but double their current-handling capabilities. (Two 50-ohm resistors in parallel = 25 ohms.) Add the value of resistance when they're wired in series. Consequently, a unit of two paralleled resistors (25 ohms), connected in series with an identical pair of paralleled resistors (25 ohms) add up to 50 ohms with increased power handling capabilities. Sounds like a win/win situation to me. All that's left to do is to dump the four of them into the pail and fire away.

Just kidding! There's a bit more to do ...

Only one of the stock Heath resistor/support assemblies will be used almost intact. (A variety of other mechanical resistor mounting configurations may be employed to achieve an identical series-paralleled result. If you elect another procedure, make certain the resistor assembly brackets extend a sufficient distance from the mounting plate such that the bank of resistors is fully immersed in the cooling oil.)

Pick out the one that appears to be in the best condition. Verify that the resistor is not open and that it reads 50 ohms. Begin by interrupting the return path to the top of the metal lid and the SO-239 ground by cutting the two aluminum brackets in half and installing two porcelain half-inch threaded insulators. Tin snips work well here. You'll find it easier to drill the two holes in

Photo C. *The second 50-ohm resistor is shown placed in parallel with the main support structure. The base is held in place with a short length of copper bridging bolted to the feedthrough insulator on one end and the U-shaped bracket of the resistor on the other end. The top support is fashioned from a length of copper stock. Note how the resistor collar is held in place with the hardware. Use one of the four threaded centering devices to attach the top brace to the aluminum tube. When you're through with the hookups, center the resistor within the tube and secure with the locking nuts. At this point, the resistance from the SO-239 input to the base of the two paralleled resistors should read about 25 ohms.*

each support for the insulating porcelain attaching bolts before snipping (see **Photo B**). Bend each support at the mark and reconnect, using some small bolts and lock washers. If locating the mini-porcelain units is a problem, snip away about half an inch of aluminum and replace it with a length of Plexiglas™ and some nut/bolt hardware.

At this point, you're just about where you started from mechanically, except that you now have an open circuit with continuity only from the center conductor of the SO-239 to the base of the resistor. Remove a resistor from a second Cantenna support assembly, keeping the top portion of the resistor intact. Cut a suitable length of copper flat stock for use as both a mechanical and electrical bridge across the top of the two resistors. Drill a hole in either end. Bolt one end onto the feedthrough insulator, using its hardware.

On the other end of the bridging material, use a small nut, bolt, and washer to connect the second resistor to the primary assembly. Remember that you left the upper U-shaped mounting straps in place to ease this hookup. Cut a second length of copper flat stock approximately six inches long. Form a collar around the bottom end of the second resistor. Drill a hole and secure the collar with a nut, bolt and lock washer. Mark and drill a hole at a point along the copper mounting strip that corresponds to the location of one of the four bottom support nut/bolt locking assemblies. They're located on the base of the aluminum tube that surrounds the main resistor.

Remove one of the bolts (along with the locking and positioning nuts) and pass it through the hole in the copper strip. Reinstall the assembly, making certain that the nuts are positioned correctly. The two resistors are now in parallel. If necessary, adjust the four set screws to ensure that the resistor is centered within the aluminum tube. Snug them up and tighten the lock nuts. You may want to use a dab of

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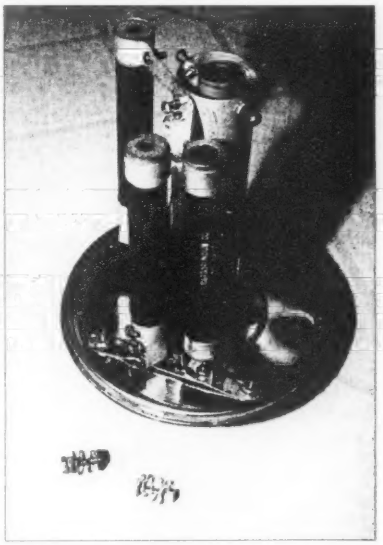

Photo D. *The four resistors are series-paralleled and secured to the original gallon lid with hardware. The two front resistors have been bolted together at the top with one set of nuts and bolts. The base of this pair has been bolted to a length of copper and firmly attached to the lid. This is the ground return, so it might be a good idea to solder all the junction points. The extra length of strapping that parallels the resistors in the rear has been shaped, drilled, and double-bolted into the junction of the two front resistors. The two spring-loaded overflow valves will be installed in the lid after drilling a one-quarter-inch hole for an extra margin of safety venting in the event of boilover.*

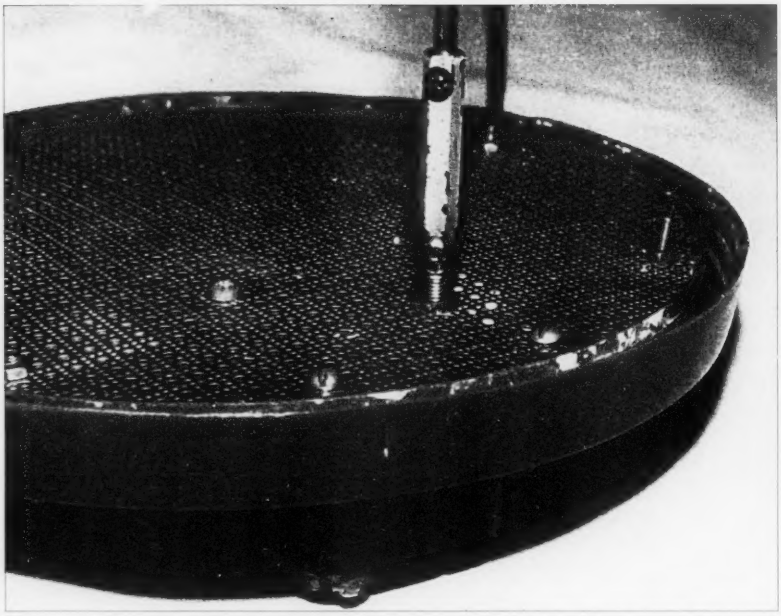

Photo E. *The gearhead motor is visible below the plastic five-gallon cover. The shaft passes through the lid via a small one-quarter-inch brass bushing. Use a one-quarter-inch coupling to attach the motor shaft to the paint stirrer. Note how the metal mesh has been fitted to the inside of the cover to contain the RF. The two (of five) sets of hardware visible to the right secure the mesh to the cover. The three (of four) roundhead bolts visible in the foreground secure the motor to the lid. It may be necessary to trim the stirrer's length in order to fit.*

Loctite™ to keep them from loosening from vibration.

Take a minute to check continuity and resistance from the center conductor of the SO-239, mounted on the lid, to the copper flat stock extension at the far end of the two paralleled resistors. The VOM should read very close to 25 ohms (see **Photo C**). It may not be a bad idea to solder all the connections at the bridging junctions.

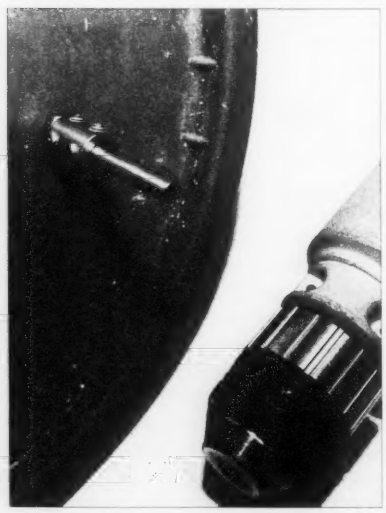

Photo F. *If you prefer not to install the gearhead motor, pass the stirrer through the bushing from the inside and secure the coupling to the shaft as a stop. Use your hand-held drill to circulate the oil.*

You're well on your way!

Remove the remaining resistors from the two Heath Cantenna assemblies. (While you're at it, disassemble the spring-loaded pressure-relief overflow valves. These units consist of a bolt, lock nut, spring, and composition washer. Drill a couple of quarter-inch holes in the metal lid for at least two additional safety venting valves, in the remote chance of overflow due to boiling.) Remove the hardware from the two resistor collars and loosely bolt them together at one end using one set of existing hardware. You'll find that bolting the two collars together in this manner is a very convenient method to parallel the second set of resistors.

At the other end of the paired resistors, bridge the two U-shaped support brackets with a length of copper strip about four inches long and bolt the resistor supports to the strip. Drill two mounting holes at each end of the strip and secure this assembly to the metal lid. Keep in mind that it's a good idea to solder all mechanical connections whenever possible.

This completes the ground return path of the circuit. You'll remember we used only a portion of the six-inch length of copper strip to connect the first resistor to the aluminum housing. Trim and shape the excess length of that strip and align the end with the upper portion of the second set of resistors where the two collars join. You'll have to drill two closely-spaced holes for through-bolting at that end.

Once these three assemblies are firmly bolted together, the two paralleled sets of resistors are in series and the circuit is complete (**Photo D**). Solder the junction point as insurance for a good electrical bond. Check your work with the VOM on the resistance scale for an input value.

The original Heath resistors have a manufacturing tolerance of ±10%, so a value of approximately 50 ohms can be expected. You'll need to know this precise resistance value if you decide to install an RF current meter to calculate power using the formula $E = I^2R$. A discussion of this option is presented in the sidebar.

The remaining steps in the assembly are a snap. Using tin snips, cut a hole in the top cover of the five-gallon container, slightly smaller than the diameter of the metal lid. Remember, there's mesh fitted to the inside cover, so cut through that material also. Center the lid and resistance assembly over the hole in the cover and secure with at least four sets of nut/bolt hardware.

In order to achieve maximum cooling efficiency from the five gallons of mineral oil, I installed an auxiliary system to circulate the oil and speed up the natural cooling convection of that fluid. To accomplish this cheaply and efficiently, I used a 200 rpm (115 VAC) gearhead motor bolted to the plastic lid of the container. [This motor is #5-1155 (200 rpm) and sells for $4.99 from Surplus Center, 1015 West "O" Street, Lincoln NE 68501-2209; tel. (800) 488-3407.]

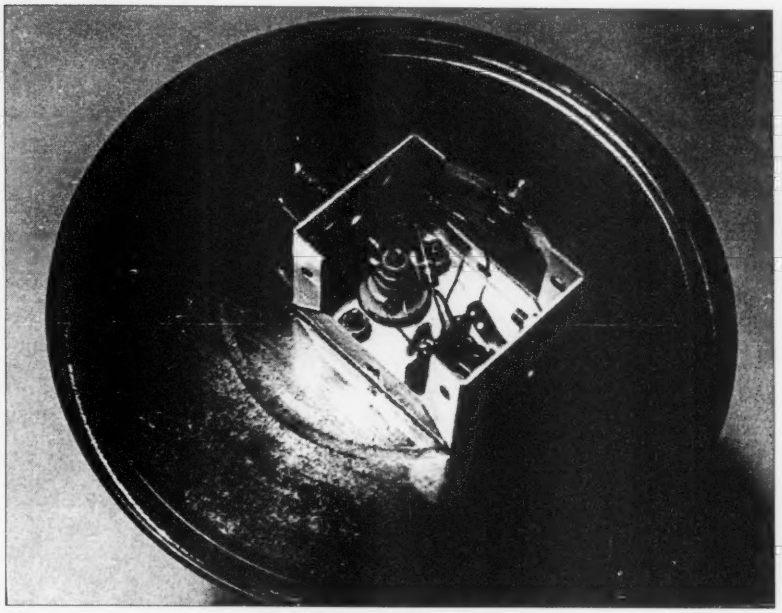

Photo G. *A view of the stock Heath Cantenna input circuit. Leave this system intact if you prefer not to install a monitoring circuit. The small disk to the upper right of the minibox is the spring-loaded safety valve. The electronic components in the original Heath design accommodated a relative output meter through the RCA phono plug mounted opposite the SO-239.*

With the shaft protruding through a quarter-inch feedthrough bushing, use a one-quarter-inch set screw coupling to connect a metal paint stirrer device (available at any home center for about $2) to the motor shaft (see **Photo E**). I had to trim the stirrer about three inches because it was a bit too long. All that's left to do is plug it in and start stirring.

If you prefer to eliminate the small motor, pass the stirrer shaft through the bushing to the outside and secure the coupling to the shaft of the stirrer as a stop collar. This will prevent the shaft from falling back into the pail. Attach a drill at this point to get the shaft and blades spinning (see **Photo F**).

That's about all there is to get the show on the road, except that you'll need an additional gallon of mineral oil to top off the five-gallon container. Your local pharmacy stocks this item. I elected to add two meters as a means of enhancing the monitoring capabilities of my dummy load. More on that in the sidebar.

If you're staying with the Heath input circuit, then a series-installed, suitably scaled, commercial wattmeter is absolutely necessary to check output (see **Photo G**). A Drake™ W4 or a Bird™ 43 (with a 2500 H–5000 H element) will handle the task with ease. Tune for maximum output and read the power directly off the scale.

If you elect to add the option of the two meters, determining output requires a simple calculation involving some multiplication. Tune the amp for maximum output on the relative output meter. Adjust the sensitivity pot on the meter chassis for a bit less than full-scale deflection. You'll want to see exactly at what point the meter reaches its maximum deflection and then begins to drop off.

At that instant, note the value of RF current on the second meter. Apply that number to the formula $E = I^2R$ (E = power, I = current, R = resistance) to calculate output power directly. For example, assume that in a test of an amplifier final, the RF meter deflects to "6" and it has been determined previously by VOM measurement that the input resistance of my dummy load is 52 ohms. I substitute these values into the formula (6 x 6 x 52) and the result is 1872 watts of power into a nearly

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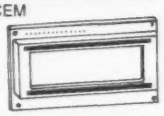

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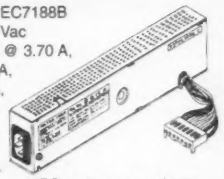

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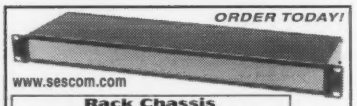

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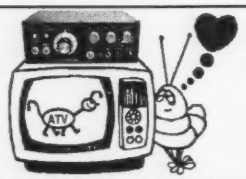

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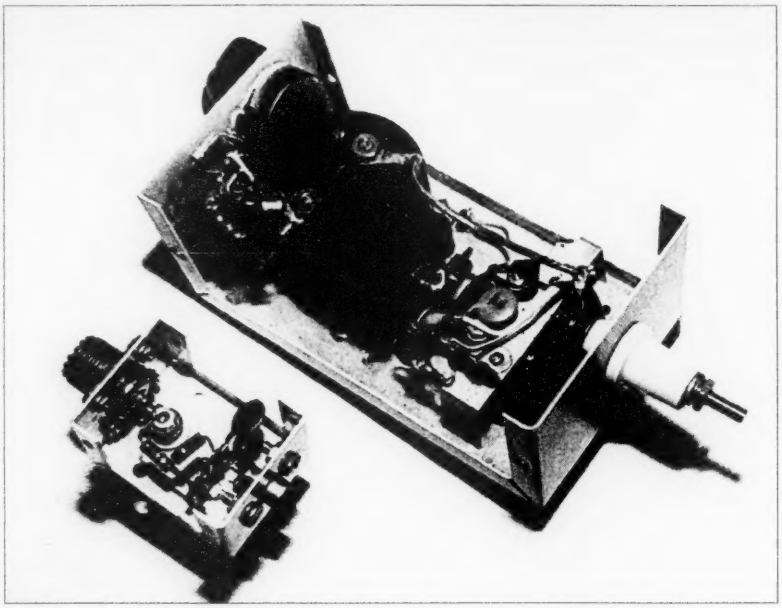

Photo H. *A view of the new minibox with the two meters installed. The Heath component in the foreground will not be used in this installation. The sensitivity pot (upper right) is in the relative output metering circuit. The feedthrough to the right eventually will pass through the gallon lid and support the resistor assembly immersed in the oil coolant. The cluster of small parts to the lower right is the remainder of the relative output circuit components. Note the #14 bus bar from the output of the RF meter to the top end of the feedthrough insulator. Circuitry is not critical, so don't hesitate to pack the components in a small space. The choke pictured to the upper left was omitted from the final circuit, so you eagle-eyed hams out there need not be upset that it doesn't appear in the schematic.*

perfect resistive load. It's as simple as that!

If you prefer to save yourself the hassle of making repetitive mathematical calculations each time you use the dummy load, prepare a solution sheet in advance. Solve the equation for a list of typical RF values and tape the solutions to the container.

By George, I think she's got it!

You may recall the movie *My Fair Lady,* in which an uneducated, ill-mannered, slovenly woman from the street was miraculously transformed into a cultured, well-spoken, socially acceptable member of society, through the efforts of an oddball language professor. Now that I've completed this project, I feel a little like Professor Higgins of movie fame. I was fortunate in having a Colonel Pickering counterpart in Lou W1QJ, who set the project on course by pointing out several shortcomings in my initial approach to the circuit details.

Now, you too can share this feeling of accomplishment. Search out four Cantenna dummy loads. With a minimum of effort and expense, retrofit the components from those salvaged assemblies to this project. As a result, you'll create a new and more powerful piece of ham shack gear, with both utility and extraordinary power-handling capabilities. When you're done, name her *Eliza Dolittle,* and if you're so inclined, change your on-the-air handle to "Professor Higgins." Good luck on the project, and I'll see you down the line! 73

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Optional Metering Panel

It's certainly convenient to have a spare wattmeter series-connected to the dummy load at all times—especially when you want a quick amplifier check. Some amateurs even hardwire the wattmeter and dummy load into the output circuit of the amplifier via a tap on the antenna selector switch. You can't beat that for accessibility. Unfortunately, high-power wattmeters are an expensive luxury when they're used only occasionally. An alternative is to permanently install two relatively inexpensive meters into your 3 kW+ Cantenna dummy load circuit. The addition of these two monitoring devices will provide the information needed to assess an amplifier's output.

Search out an RF ammeter rated at six to eight amperes. Make a hamfest visit for this meter ($3 to $5, usually). Otherwise, check availability and prices with Surplus Sales at [www. surplussales.com] or E-mail [grinnell @surplussales.com]. This little gem reads RF current directly in amperes through an internal thermocouple. Substituting the meter readings into a simple mathematical formula determines the actual RF power output to a known resistive load.

The second monitoring device is a garden variety 1 mA full-scale meter wired to read relative output. Any logging scale will do just fine, since its purpose is to read maximum deflection only. As a matter of fact, look specifically for an odd scale. The price will be cheaper.

If you want to keep expenses low, select two-inch meters. Don't hesitate to pack the components into a small metal enclosure (see **Photo F**). Circuitry is not critical! The RF meter is wired in series with the center conductor of the coax cable from the linear. Use #14 copper wire from the SO-239 inner contact point to one of the meter terminals. Complete the circuit by connecting a second length of #14 wire from the second meter terminal to a solder lug at the top end of the porcelain feedthrough insulator (salvaged from one of the Cantenna mini-enclosures).

There are no high-current concerns when wiring the second meter into the circuit, so light-gauge hookup wire is OK; however, this meter requires a few more parts.

Basically, what's happening here is that a minuscule amount of RF current is sampled through a resistor. It's rectified by a small diode and fed in a controlled manner through the sensitivity potentiometer directly to the "+" terminal of the relative output meter. From the schematic (**Fig. 1**), follow the path of the DC potential and the wiring will be a breeze.

To use the system, adjust the sensitivity control for about 3/4 meter scale when under load and fine-tune the amp for maximum deflection. Once that control has been set, it probably will never have to be readjusted. At the moment of maximum meter movement, note the value of the RF current analog scale and apply that number to the formula $E = I^2R$. Don't worry if math intimidates you. Simply multiply the numerical value of the RF meter readout (I) by itself (I^2), and then multiply that product by the pre-determined input resistance of your dummy load.

Life would be so easy if the RF value happened to be a nice round number and your dummy load was exactly on the money at 50 ohms. Unfortunately, Murphy and his vexing laws are not that accommodating. Note the value of the RF meter readout along with the resistive value of the dummy load, plug those figures into your pocket calculator, and let *it* do the number crunching.

To illustrate the point, run these hypothetical values to check out the formula: RF current 4.8; Cantenna resistance 52.7 ohms. Using the formula $E = I^2R$, substitute the meter readout values and solve (4.8 x 4.8 x 52.7 = 1214.2 watts). It's as easy as that.

If you agree that built-in monitoring makes good sense, find a metal enclosure for the components. Mount the meters, wire up the circuit, and through-bolt the enclosure to the metal lid supporting the dummy load resistors. Obviously, you'll have to remove the original Heath-installed mini-enclosure. Good bonding is essential at these points to ensure a zero-resistance ground return path. Use at least three through-bolts with star washers (internal teeth) for the best metal-to-metal bond you can get. Hook up the input of the first set of paralleled resistors to the output side of the feedthrough porcelain insulator to complete the wiring.

If you recognize the utility of an in-line metering console and realize that it has additional value as a portable through-line monitoring device, then consider this hookup. Construct the console in the regular manner following the schematic. Instead of using the porcelain feedthrough on one end, replace it with a second chassis-mounted SO-239. To hook it into the dummy load, use a double-ended PL-259 (Radio Shack #278-192) connected to the lid-mounted Heath Cantenna minibox input you've left intact.

When all the dummy load testing is completed, remove the metering station and position it in series on your coaxial line to continually monitor output to the antenna. Keep in mind that the use of the formula $E = I^2R$ for accurate power output indication requires a known value of antenna input impedance. You can always assume manufacturers' specifications (with some wariness) or consider using an antenna bridge. The MFJ-259 or the Palomar RX100 will work well. Either of these two handy devices determines the exact resistance in ohms. That value can be substituted into the formula when it signals that the array is at resonance and the load that's displayed on the meter is purely resistive.

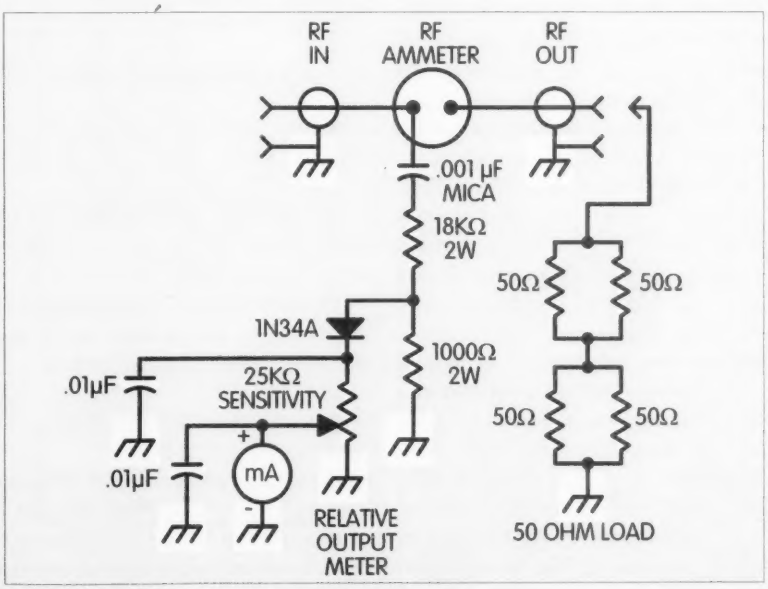

Fig. 1. Schematic of monitoring panel console.

Networking with Thevenin and Kirchhoff

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Network analysis isn't about lying on the couch of a network of psychiatrists, but it could lead to that. Network analysis is the process of determining the voltage across an impedance or the current in it that is so essential in the design or analysis of any circuit. Sometimes the answer is obvious, but other times it's obtuse, or so it seems. Don't despair; there are only a couple of laws or theorems needed to let the light shine through. The laws are few and simple, but depending on your facility with algebra, one may be easier to use than some other. In any case, the laws and theorems are essential to network analysis.

The basic laws, really axioms, are the two Kirchhoff's laws. Axioms are self-evident and universally accepted truths: Kirchhoff's voltage law states that the algebraic sum of all the voltages in a closed circuit is zero. That is to say, the sum of the voltage drops around a circuit is equal to the voltage(s) applied to the circuit. The current law states that the algebraic sum of the currents into and out of a point is zero. That is, there is as much current flowing away from a point as there is flowing toward it. From these laws, several theorems have been developed. Theorems are demonstrably true based on the accepted assumptions. In the case of network analysis, Kirchhoff's laws are the accepted assumptions.

There are a few theorems derived from these axioms that reduce a complex network to a more manageable equivalent circuit. Thevenin's theorem, Norton's theorem, and the Superposition theorem are the workhorses. Of course, the loop equations for Kirchhoff's laws can be written and the simultaneous equations solved, but that usually takes a bit more effort.

Thevenin's theorem is useful in reducing a complex network containing many elements to a single constant voltage generator with a single impedance. The theorem states that any network can be replaced, with respect to any two external terminals of the network, by an equivalent network that consists of a voltage generator with an internal impedance that is equal to the impedance measured between those two points when all of the generators in the network are replaced by their internal impedances. **Fig. 1a** shows the general Thevenin's network. **Fig. 1b** shows the DC network equivalent. **Fig. 1c** shows the equivalent network providing bias for a transistor.

For example, if it is desired to find the current that will flow in the base of the bipolar transistor with $V_{BE} = 0.6$ V when biased with the circuit of **Fig. 1**, Thevenin's theorem shows the way. The voltage E_G of the equivalent generator at the junction of the 6.8 k and the 2.2 k is:

$$E_G = 9 \times 2.2\text{ k}/(6.8\text{ k} + 2.2\text{ k}) = 2.2\text{ V}$$

and the equivalent generator R_G resistance is:

$$R_G = (R_1^{-1} + R_2^{-1})^{-1} = (6.8\text{ k}^{-1} + 2.2\text{ k}^{-1}) = 1.662\text{ k}$$

Therefore, when the base junction is connected to the junction of R1 and R2, the current in the base will be

$$(2.2 - 0.6)/1.662\text{ k} = 0.962\text{ mA}.$$

Norton's theorem is useful in the solution of network problems in which it is necessary to reduce a complex network to an equivalent network consisting of a constant-current generator shunted by a single impedance. This

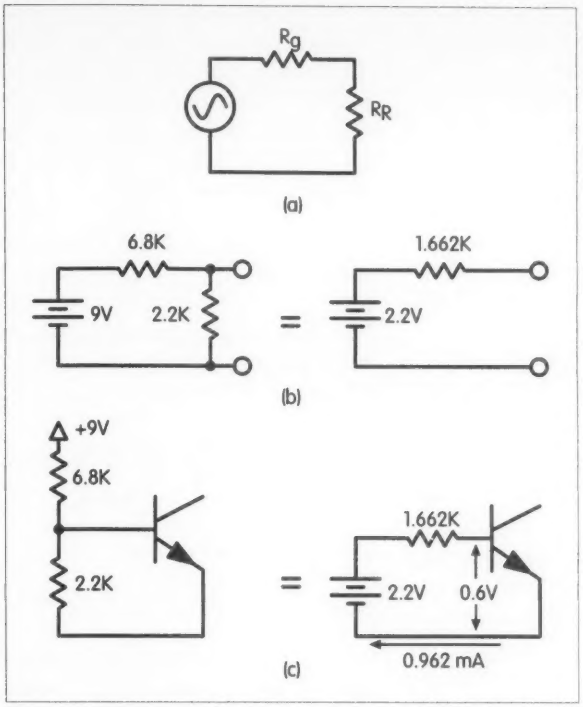

Fig. 1. Thevenin's equivalents. (a) General Thevenin's network. (b) DC network equivalent. (c) Transistor bias equivalent circuit.

current is equal to the short-circuit current I_{sc} measured between the terminals of the original network in shunt with the impedance Z_G (or admittance Y_G) seen looking back into the original network from the terminals when all generators are replaced by their internal impedances. Norton's theorem is similar to Thevenin's theorem except that current sources are used instead of voltage sources. When a constant-current source I_{sc} is shunted by a resistor r_g, the voltage across the generator is $I_{sc}r_g$ and the generator's internal impedance is r_g. The Norton generator is then equal to a Thevenin generator with a voltage $E_G = I_{sc}r_g$ and a generator internal resistance of r_g.

Norton's theorem is not as commonly used as Thevenin's because we usually think in terms of voltage sources, not current sources. However, there are some devices that approximate a constant-current generator: The drain of an FET approximates a current equivalent circuit consists of a constant-current generator with infinite internal impedance, whose generated

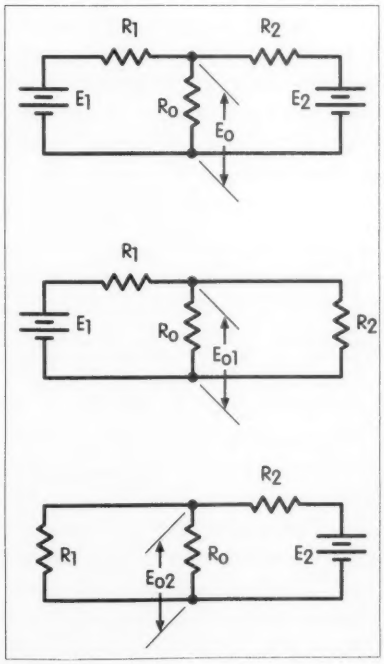

Fig. 2. An arbitrary network with two generators.

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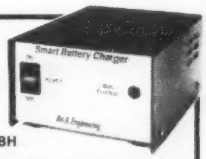

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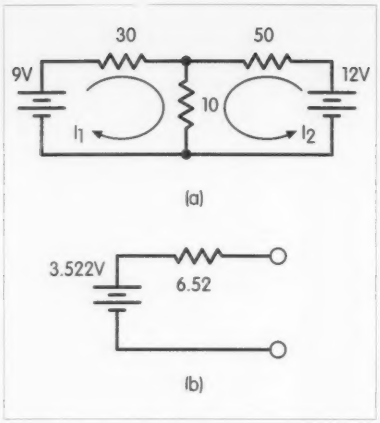

Fig. 3. A two-source network can be solved with Kirchhoff's laws.

source when the transistor's drain-to-source voltage is greater than pinch-off. The drain current is $g_{fs}V_{gs}$ and is essentially independent of drain voltage. The collector current of a bipolar junction transistor, $I_B h_{fe}$, also represents a current source when the collector is operated unsaturated.

The Superposition theorem is useful in determining the voltage across two external terminals of a complex network. The theorem states: "The current in any branch or the voltage across two external terminals distributed in any manner throughout the network is the sum of the currents or voltages which would be produced by the individual generators acting alone with all the other generators replaced by their internal impedances." **Fig. 2** shows an arbitrary network that has been divided into two separate networks, each containing only one generator. The component of the output voltage E_o produced by E_1 is E_{o1} and the component resulting from E_2 is E_{o2}. The voltage E_o across R_o is the sum of E_{o1} and E_{o2}:

$$Eo_1 \text{ (with } E_2 \text{ shorted)} = E_1(R_o^{-1} + R_2^{-1})^{-1} / [R_1 + (R_o^{-1} + R_2^{-1})^{-1}]$$

$$E_{o2} \text{ (with } E_1 \text{ shorted)} = E_2(R_o^{-1} + R_1^{-1})^{-1} / [R_2 + (R_o^{-1} + R_1^{-1})^{-1}]$$

$$E_o = E_{o1} + E_{o2}$$

Any number of single-generator circuits can be solved in a similar fashion.

The Superposition theorem and Thevenin's theorem make a potent pair for solving almost any complex network. The Superposition theorem produces the equivalent Thevenin's generator E_G and the Thevenin equivalent generator impedance is R_o, R_1, and R_2 in parallel or $(R_o^{-1} + R_1^{-1} + R_2^{-1...})^{-1}$.

Applying the Superposition theorem to the network of **Fig. 3** shows:

$$E_{o1} = 9(10^{-1} + 50^{-1})^{-1} / [30 + (10^{-1} + 50^{-1})^{-1}] \approx 1.957 \text{ V}$$

$$E_{o2} = 12(10^{-1} + 30^{-1})^{-1} / [50 + (10^{-1} + 30^{-1})^{-1}] \approx 1.565 \text{ V}$$

$$E_o = 1.957 + 1.565 = 3.522 \text{ V}$$

Of course, E_o can be obtained by solving the simultaneous solutions of the two loop equations of Kirchhoff's law. Applying Kirchhoff's laws to the two loops of **Fig. 3** shows:

$$9 = 30I_1 + 10I_1 + 10I_2 = 40I_1 + 10I_2$$

$$12 = 50I_2 + 10I_1 + 10I_2 = 60I_2 + 10I_1$$

The simultaneous solution of the two equations requires multiplying one of the equations by a factor that eliminates one of the terms when the equations are added. For example, multiplying the second equation by -4 and adding it to the first equation produces:

$$[-48 = -240I_2 - 40I_1] + [9 = 10I_2 + 40I_1] = [-39 = -230I_2] = [I_2 \approx 0.1696]$$

Substituting this value for I_2 into one of the equations permits a solution for I_1:

$$9 = 40I_1 + 10 \times 0.1696 = 40I_1 + 1.696$$
$$40I_1 \approx 7.304$$
$$I_1 \approx 0.1826$$

The output voltage E_o is $R_o(I_1 + I_2)$.

$E_o = 10(I_1 + I_2) \approx 3.522$, which agrees with the answer found with the superposition theorem.

The equivalent generator impedance is: $R_G = (R_o^{-1} + R_1^{-1} + R_2^{-1})^{-1}$. The solutions found with both the Superposition theorems and Kirchhoff's laws resolve into a Thevenin's equivalent of a generator voltage of 3.522 V whose impedance is 6.52.

Either the Superposition theorem or application of Kirchhoff's laws can find the E_o of a network. In some cases, a combination of simplifications is beneficial.

For example, the network of **Fig. 3** is redrawn in **Fig. 4**. The difference is that in **Fig. 4**, R_o is not connected. Application of Kirchhoff's voltage law reveals the voltage across R_1 and R_2 to be 3 V and the current through them, 0.0375.

Therefore, the voltage at point A is 9 + 1.125 = 10.125 or 12 - 1.185 = 10.125. Thevenin's equivalent circuit at point A is a 10.125 V generator with an internal impedance of 18.75. When an R_o of 10 is connected at point A, the voltage at A drops to 3.522 V, which agrees with the solutions found with

Continued on page 39

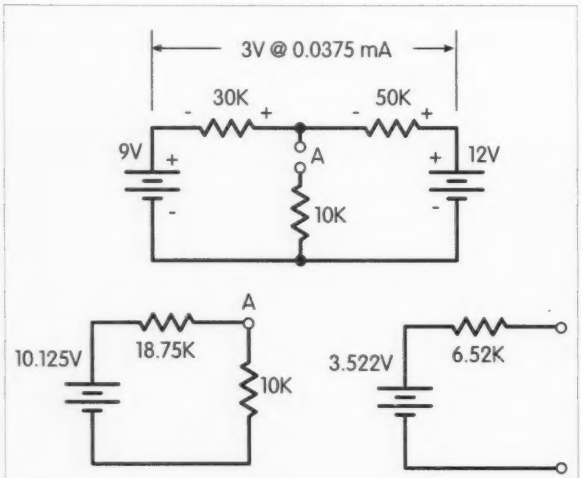

Fig. 4. Further simplifications can ease the solution of two-source networks.

Triband Vertical Array for Big 120° Bandwidth Signal

(Or, what to do with the trap beam pieces parts in the basement.)

Andrew H. Kilpatrick WZ8A
7330 Mallard Drive
West Chester OH 45069-1028

The old knock on verticals has always been that they generate "an equally poor signal in all directions." It is true that the simple quarter wave vertical doesn't have the directivity or ground reflection gain of a basic dipole. It is also true that at ground level, a vertical is especially susceptible to absorption and loss from nearby homes, trees, power lines, and other foes of efficient transmission and propagation.

However, vertical polarization is the only way to generate a true surface wave (up to 50 mile radius for consistent ground communication), and for the really long haul DX, it's the most cost effective way to propagate low angle radiation. Additionally, when using a single element vertical, you will never miss hearing a rare station because your beam was headed in the wrong direction. Typically, I have found that signals coming in on my verticals are seldom strong on the S-meter. That's partly due to not having the gain of a truly directional antenna, and has something to do with what is called antenna "capture area." However, if I hear them, they can hear me. Q5 is Q5, even if I'm not 20 over S9. My experience has been, the farther away the station is, the better my chances are of breaking the pileup with my vertical and 100 watts.

First, let's consider some of the basics for a quarter wave vertical. Its radiation resistance is half that of a dipole. Makes sense, since it *is* half a dipole. A dipole up at least a half-wave above the ground will have about a 75 ohm input impedance. (For dipoles, that suggests using RG-59 feedline for the best match, not RG-8 or RG-58, as commonly used.) The other "half" of the quarter wave vertical is the "image antenna" that effectively appears when the feedline shield is connected to a good ground. If the ground is perfect, the "image" adds zero to the radiation resistance. So the load resistance should be about 37 ohms for a well grounded vertical using no tuning circuitry.

Therefore, if your RG-8 or RG-58 coaxial cable (coax) provides a 1-to-1 match to your quarter wave vertical, the ground system needs improvement! If your SWR measures about 1.4:1 going to your ground-mounted vertical, then your ground system is very good (the ideal 37 ohm load), or awful. A 75 ohm vertical input impedance will also provide a 1.4:1 ratio, but suggests you have more of a ground warmer than an antenna.

Remember, too, that for HF purposes, a good ground is not determined by how deep your ground rod is, but by how much conductive ground material you have around the vertical element, near or at the surface. I like to take a 100-foot roll of heavy fence wire, crisscross it centered at the vertical, and tack it down with gutter spout nails. It can then be covered with dirt and grass, if aesthetics are of importance. A radial layout of wires works also, but takes much more work than the wire fence approach.

With conductive terrain around you, such as Ohio farmland, wetlands, or a lake, the vertical can be the best DX antenna you would want, at least within reasonable budget restraints. And remember, a ground-mounted vertical keeps both your feet on the ground for all critical adjustments—making it an excellent all-season antenna to use and maintain. Just brush the snow back a few inches from the base in the winter, and expect improved ground conductivity. No end insulators to break down in the rain or ice. The feedpoint

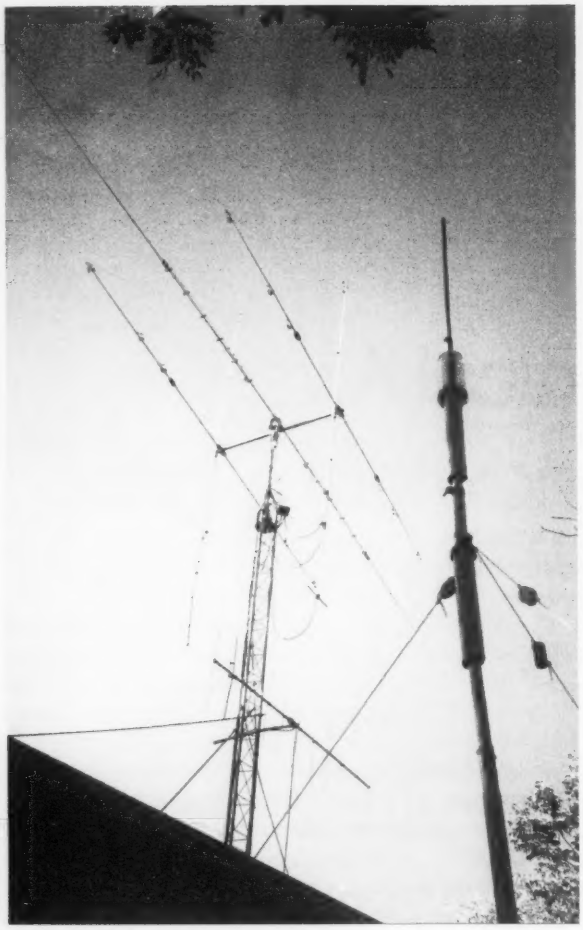

Photo A. *WZ8A vertical and quad used for comparative signals.*

insulator needs to withstand less than 250 volts running the maximum 1.5 kW output, and less than 70 volts running barefoot.

Speaking of voltages on the vertical: One of the concerns with a vertical is that without some sort of fence (preferably wooden) around it, the radiating element can present a hazard. Running 100 watts to a vertical implies an RMS voltage at the antenna base of 60 to 70 volts. Not that serious a shock threat, although touching it above the base means higher voltages and a definite possibility of "frostbite" (RF burn). Most hams have had one or two of those blisters before, but a neighbor with an attorney friend might not take such things so casually—especially if it's a child who gets nipped. With an amplifier, the base voltage can go above 200 V_{rms}—a definite safety hazard. So put a wooden fence around the base of your vertical, and use the fencing to provide an anchor point for the light guy-string support of the vertical element needed in windy weather. Do not make someone's lawyer richer over an RF nip.

I took a big bite from RF when I was 18, while adjusting a variable antenna link with the transmitter activated. Touched about 200 watts of RF sitting on the 1.8 kV going to the plates of my two 814s (old-time pentodes). My muscles shot me back into the wall about 6 feet behind the transmitter. The crack my elbow took on the wall momentarily kept my mind off the RF and electrical burn.

After the pain subsided in my elbow, the doctor got to look at my hand. "How *did* you get that? I've never seen such an interesting burn." That was all the "sympathy" I got from good ol' Doc. It looked like a jagged lightning bolt had left its imprint on the side of my left hand. Doc suggested that I not repeat whatever I did to earn my pain.

As far as your backyard antenna goes, there should not be any 1.8 kV of DC attached to it, and the RF voltage drops quickly when someone detunes the antenna with a finger or a hand. So touching a hot vertical should not normally be lethal, but it's still not fun to get "bit." Running 50 watts to a vertical (as in the case of running 100 watts to a pair of phased verticals) should be safe. Otherwise, invest in that fence for safety's sake.

In Novice days, I would tune the gamma match to my 10-meter beam by leaving the transmitter on low power, holding the driven element with my healed left hand, and tuning the series capacitor for maximum burn. As the RF got hotter, I would slide my hand in toward the feedpoint to reduce the hurt and the detuning caused by the hand. Maybe that's why my hair was receding in high school. Don't do that with your vertical. Adjust your antenna length using a reflected power (SWR) meter. Meters are cheap these days; try Radio Shack or your local amateur radio store. Most radio handbooks show a simple SWR meter that can be built with a handful of parts.

I wrote a C program to assist my calculations for the phased vertical array. The HAMVERTS program calculations for E (vertical element length) should be close enough that meter tuning is not a necessity. However, adjusting the element length for the measured SWR minimum does give you the exact resonant point you desire. Nearby metal objects can make the actual resonant length shorter than calculated; the program takes into account the width of the tubing, which also affects the electrical length.

The purpose of the HAMVERTS PC program is to easily generate the exact quarter wavelengths you need for any frequency. There are actually three 1/4 wavelength values generated for any given frequency: 1) the antenna 1/4-wave element length, which has the width or end effect factored in; 2) the coax 1/4 wavelength, which takes into account the "velocity factor" of the coax; and 3) the "free space" 1/4 wavelength, which is used to space the element distances. Before discussing the HAMVERTS.C program further, let's discuss a directional vertical.

The 90°x90° phased vertical is easy to construct, provides significant gain (4.5 dB), and has a broad (120°) half-power bandwidth. Its cardioid (heart-shaped) pattern provides about 20 dB of side attenuation and 30 dB of rear attenuation. So for working one continent, such as Europe—two elements directed at 45° (NE) works all the counties very nicely from Ohio. As a regular Worked All Europe contestant, I like that broad bandwidth gain feature.

The array takes two verticals, both tuned to the same resonant frequency, with a free-space separation of 1/4 wave (90°). The second driven element has an extra 1/4 wavelength of coax to delay the RF power to it. So, by the time the power going to the first element propagates to the second element, the second element power is exactly in phase with the energy coming from element 1 (1E). Conversely, by the time the energy from element 2 propagates back to element 1, the energy from element 2 (2E) is exactly out of phase with the power being radiated by element 1. Obviously then, the peak radiation will occur in the direction of element 1 toward element 2, and on. Looking back from element 2 towards element 1, there should be almost perfect cancellation. This is what creates the cardioid gain pattern.

Measured coax lengths provide the 1/4-wave time delay essential for phasing the two antennas. Think of the coax as many sections of small inductors (the center wire) and capacitors (the braid and center conductor, with a plastic or foam dielectric separating these two "plates" of the capacitor). Power is not lost by charging these capacitors through these small inductors, but it takes time for each capacitor to charge and pass its energy on to the next coil and capacitor. So instead of the radio power traveling at the speed of light down the coax wire, it's running much slower. (Yes, a straight piece of wire is an inductor.) With plastic insulation, about 1/3 slower than the speed of light. This means that a 1/4 wavelength of coax will only be two-thirds the distance that the two elements should be separated for a free-space equivalence of 1/4 wave.

So, in addition to the electrical 1/4 wave of coax going from element 1 toward element 2, an extra 33% length must be added just to physically reach the second element. As long as the same extra length is added to the feedline going to element 1, the 90 degree phase difference is maintained. Actually, adding 1/6th of a quarter wavelength of coax between the "T" and element 1, and the "T" and element 2, plus the 1/4-wavelength delay section, will make the distance. The phasing would be correct with any additional length, as long as the element 2 (2E) transmission line leg is electrically 1/4 wave longer than the leg to element 1.

The problem then becomes: "What about the match?" If the vertical's base impedance is 52 ohms, and RG-8 or RG-58 coax is used, then two 50-ohm loads would be paralleled at the "T" connection, resulting in a 25 ohm load, or a 2:1 SWR to the transceiver. But the impedance of the verticals should be closer to 37 ohms, and now the impedance seen at the "T" will be complex, a function of both the lengths of coax from the vertical elements to the "T." What the transceiver will see as a load impedance will depend on the impedance at the "T," transformed by the length of coax from the transceiver to the "T." It could be nasty.

The solution is simple: The transformation equation of the quarter wave matching section is the answer. For a quarter wavelength of transmission line, the product of the line impedance (Zo) squared is equal to the product of the two end impedances, or Zo x Zo = Zin x Zout. Zo is the coax surge

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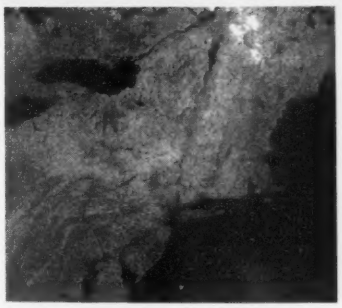

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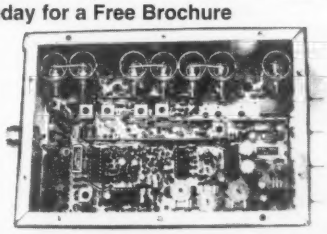

Triband Vertical Array

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impedance—52 ohms for RG-8, or 73 ohms for RG-59.

According to the 1/4-wave transformation equation, if the input impedance to a quarter wavelength of 52 ohm coax is 37 ohms (such as a 1/4-wave vertical should be), then the impedance at the other side of the coax section would be 73 ohms (matching RG-59 cable). If the match is close, then the length of coax to the transmitter will not affect the impedance match to the transmitter. Most transmitters will have no problem coupling to a 73 ohm load efficiently.

For the phased verticals, using 1/4 wave of 73 ohm coax to element 1 yields an input impedance of: 73 x 73 / 37 = 144 at the "T" connector. Using 1/4 wave of RG-58 to element 2 yields: 52 x 52 / 37 = 73. Now, adding the 1/4-wave section of RG-59 for phasing to the element 2 line does not change the 73 ohms going to the "T" connector. The two parallel loads (144 || 73) work out to a very nice 48.5 ohm match to the RG-8 or RG-58 coax going to the transmitter. The power going to the two elements will not be equal, however, causing a slight loss of forward gain and front-to-back ratio. These are not high-Q circuits we are dealing with here, so neither the lengths nor the match have to be precise for good results.

By using 1/4 wave of 73 ohm coax (RG-59) from element 1 to the "T" and 1/4 wave of 52 ohm coax (RG-58) from element 2 to another 1/4 wave of 73 ohm coax (RG-59) to add the phasing delay, a combined load appears to the transmitter feedline that nicely matches 50 to 52 ohm coax. If you are using a short (loaded) vertical, the vertical's load impedance will be lowered, making the "T'd" impedance higher and actually improving the SWR situation.

For a 40 meter 90°x90° array of two 22.5 foot linear loaded elements, I used a 50-ohm 1/4-wave section to element 1 (50 x 50 / 25 = 100), as well as element 2, for an almost perfect match at the "T" connection. The two 40 meter elements are currently used as a 40 meter rotatable dipole up between my triband quad elements. The input to the dipole measures 25 ohms. Paralleling two quarter wavelengths of RG-59 yields a quarter wave section of 36.5 ohm coax that perfectly matches my dipole to 53 ohm coax.

My HAMVERTS.C program, which runs as a PC DOS executable file, calculates all three flavors of 1/4 wavelengths, once the coax insulation type and element diameter are specified. You can request a free copy of the executable file via E-mail at [hamverts@aol.com], or send a blank floppy and a postage-paid return envelope.

If a frequency value between 1.0 and 148.0 MHz is entered when running HAMVERTS.EXE from PC DOS, the antenna calculations will be made for just that one frequency. Three values

HAMVERTS (WZ8A antenna calcs for 90° x 90° phased vertical array)
At least one, and not more than 8, frequencies should be entered.
Each frequency value must be between 1.0 and 148.0 MHz.
The vertical element average diameter (inches) is used for all frequencies.
As an example: hamverts 28.2 21.15 7.125
Assume PVC (plastic) coax insulator (dielectric) for this example.
Also, assume the average diameter of the vertical element is 1 inch.
Dimension & coax lengths for two 90° x 90° phased verticals — WZ8A calculations —
Assumed velocity factor = 0.66 The 1E & 2E avg. diam. = 1.0 in.
x = z = RG-8/U or RG-58/U, 52-ohm plastic dielectric coax
y = RG-11/U or RG-59/U, 75-ohm plastic dielectric coax
S = Quarter wave spacing between vertical elements
1EyyyyTzzzz> xcvr
s y (z..z = any length of 52-ohm coaxial cable)
s y (T = "tee" connector & "barrel," i.e. M-358 & PL-258/U)
s y (x..x & y..y are electrical 1/4 wavelengths, y = 75-ohm coax)
s y (* = straight jack-to-jack "barrel" connector, PL-258)
2Exxxx*
ˇ
ˇ direction of forward gain

FREQUENCY	1/4 Wave Coax Length	Element Height	Element Spacing
28.200 MHz	x & y = 5 ft. 9.1 in.	E = 8 ft. 5.0 in.	s = 8 ft. 8.7 in.
21.150 MHz	x & y = 7 ft. 8.1 in.	E = 11 ft. 2.7 in.	s = 11 ft. 7.6 in.
7.125 MHz	x & y = 22 ft. 9.5 in.	E = 33 ft. 7.2 in.	s = 34 ft. 6.4 in.

Table 1. *HAMVERTS example.*

are printed to the screen for each frequency: x represents the length of 1/4 wave of coax; s represents the 1/4-wave spacing between the two vertical elements; and E represents the height of the vertical element, with the element size being accounted for. Up to eight frequencies can be run at one time. If no frequency is entered for calculation, just typing "hamverts" will present the instructions and calculate three frequencies. An example is shown in **Table 1.**

Calculated lengths do not vary greatly between SSB and CW frequencies. So these three example calculations for the 40, 15, and 10 meter Novice bands would be an excellent compromise for General phone and CW operation. Note that the dielectric information can be entered either as a decimal value, or the letters P or F for plastic or foam dielectric.

I wrote this HAMVERTS.C program to determine the optimum spacings for my 10, 15, and 20 meter frequencies of choice, and then reconstructed three triband vertical elements out of the traps and tubing from my TH2MK3 remains. In its latter years of use, the triband two element beam had been reduced to a two-band, two-element, 10 and 15 meter beam with optimum spacing for both bands by tuning the parasitic element as a reflector on 10 meters and a director on 15 meters. It worked up to full expectations, as long as I remembered which way to point it for the band I was on.

For the vertical operation, I only needed to replace the weather seals on the top ends of the traps and run a few spiders out. The 15 meter traps were cleaned up and reassembled to again make each element fit for triband duty. Two of the verticals were set up just outside my basement shack location, and the third element was located as my reference receiving antenna, as far from the two-element array as possible. Actually, that was 120 feet from the closest driven element, or about 1.7 wavelengths on 20 m and 3.35 wavelengths on 10 meters. The reference element was still too close for meaningful front-to-back measurements, but gave general gain readings.

I tried to keep the power levels low and use clear frequencies for testing, as well as sending my call ID regularly. The first time I keyed down for 15 seconds—running 10 watts to one element on the most perfectly clear frequency I could find—back came someone curious about the "A0" signal. It really makes me wonder where all the callers are when I call CQ with my kW running. But no problem—I had a quick QSO with Ken in Houston, explained the testing, and continued on with my antenna project.

The same thing happened when I ran a "testing" message on a 2 meter simplex channel I thought no one ever used. The purpose was to allow a cable service technician to find and fix their leaks (egress). My ingress on the same frequencies was bothering cable channel 18 (same as 2 meters) watchers. After just a few minutes of test transmissions for the cable people on this once-dead simplex frequency, hams came out of the woodwork to find out what was going on. We are a curious lot, are we not?

A minor problem was locating my reference antenna directly inline with my two phased driven elements. An assortment of black walnut trees, sumac (poison and otherwise), and buckeye vegetation obscured the exact location of my reference antenna. So I hung a 27-inch-wide orange Halloween decoration halfway up the reference vertical so that I could spot it when aligning the position of my second driven element. That improvement allowed me to locate my line of direction well beyond any reasonable need.

By the time I returned to the back corner of my lot to retrieve the orange marker, my neighbor at the back corner of the yard had noticed the white backside of the decoration. She quickly came out to ask: "That's not a TV satellite dish your putting up there, is it?" I assured her it was not a TV dish, showed her the Halloween decoration she was taking note of, and returned to my basement shack—leaving the 14-foot vertical with two traps at eye level for her convenient kitchen window viewing.

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Triband Vertical Array

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My first testing was done with each of my 1/4-wave elements being tested individually with a quick and dirty ground. The vertical ground consisted of a three-foot length of 3/4-inch copper water pipe, left over from our last water leak episode.

The coils that made up the Hy-Gain coils consisted of aluminum wire wrapped around an insulator form, and tap-screwed on each end into the aluminum element tubing. Just like my old aluminum house wiring in Florida days, those pressure connections with aluminum wire have to be tightened every so often to maintain good contact. The same is true for Hy-Gain traps. Also, some crystalline formations between the turns were scrubbed off with rubbing alcohol and an old toothbrush. After the cleanup and tightening, the traps again performed as expected.

After adjusting the element sections for resonance at the low end of 10, 15, and 20 meters, I checked the SWR on all three bands. Almost perfect at the rig, and indeed my MFJ-205 resistance meter measured the resistance right at 50 to 53 ohms. (Remember, I said that is *bad;* a good ground means some mismatch!) So, a trip to the hardware store, $23, a 50-foot roll of welded fence wire, and the SWR now goes to 1.4:1, and the resistance meter now claims I've got a 37-ohm load.

However, the triband business is optional. To keep it simple, make your phased vertical for just one band. Make the driven elements (E) from copper or aluminum tubing, insulate the base of the vertical with a coke bottle, a few inches of PVC, or anything that doesn't become a good conductor when it gets wet. To keep my elements in line, I used three nylon guy cords per vertical. Each cord was fastened to one brick about 8 feet from the base. Bricks make a great guy anchor. The verticals stand straight in strong winds, but the brick will slide when a kid or careless owner runs into the cord or an element at night; everything gives, and no one is hurt. However, there could be a slight esthetics problem using brick guy anchors.

The coax phasing sections are not critical with respect to length. These lengths do not represent tuned circuits with a high Q; listing lengths with the inches broken down into fractions is a bit excessive, but the computer does it for free. It is important to make those calculations based on either foam or PVC insulation. Selecting the mid-Novice band frequencies for 40, 15, and 10 meters will result in spacing suitable for full use of all normal CW and SSB sections of those bands. A slight trim of the driven element lengths might be desired for CW and SSB, but adjusting the coax phasing lengths will meaningfully change the gain and directivity of the antenna.

To measure the coax, I used the basement method (same as garage method):

1. Mark the desired length of the coax phasing section on your cement floor.

2. Solder one PL-259 to one end of the coax section.

3. Stretch the coax out between the marks, with paint cans to hold the coax in place.

4. Wrap tape around the coax to mark the exact length calculated by the "HAMVERTS" program.

The x and y phasing sections going to the antenna require only one connector per cable. For the other end, separate a few inches of coax braid and center conductor down to the edge of the marking tape, and use a 1-inch hose clamp to fasten the coax to the vertical element. The braid can be soldered to the ground rod or ground screen. I like to add a moisture sealant around the braid section to keep water from wicking up the coax braid and possibly reducing the efficiency of the transmission line.

The z..z (any length) and y..y (75 ohm) phasing sections to the phased array need PL-259s on each end. I use the tip ends of the pins on each PL-259 to make my total length measurements, but it is not critical. Do use reducing adapters (UG-175 for RG-58, or UG-176 for RG-59) when using the smaller diameter coaxial cables. That is in addition to the six PL-259s, two barrels (PL-258), and one tee (M-358)

connector required for neatly splicing all the feedlines together. For this project, I followed Bob Simpleton's "guide to PL connectors" and got some superbly clean looking connector results. That follows many years of "figuring it out myself," with sometime unreliable PL-259 connections.

With my triband vertical configuration spaced for 20 meters, I expected an omnidirectional signal on 20, a somewhat omnidirectional signal on 15 meters (less forward gain, and some power off the back), and a simple bidirectional (endfire) pattern with about 2.3 dB of gain in the plane of the verticals and about 20 dB of side attenuation.

Of course, the operating is the proof of any antenna. I could see very noticeable front-to-back and front-to-side gain with the verticals. The two ground-mounted verticals worked stations in the desired direction with ease. I cannot report that the vertical topped my 2-element quad up 40 feet, but then again, with much less hardware and no holes in the house roof (needed to keep the quad up), the verticals come within one to two S-units of the big antenna. In general, the farther away the stations are, the closer the vertical comes to the quad in performance. And with the sunspots increasing, I'm expecting my 90°x90° to do a very nice job on my next Field Day or DXpedition. Give it a try—it's a winner. 73

Networking

continued from page 32

both the Superposition theorem and Kirchhoff's laws.

There is more than one way to skin a cat. There is also more than one way to calculate the value of resistors in parallel. Before the days of the inexpensive hand-held calculator, the common way to find the value of two resistors in parallel was to use their product over their sum. A calculator that has a single key for reciprocals makes the sum of conductances a much quicker and easier way of finding the effective resistance of resistors in parallel.

The most complex circuits can be simplified and solved with the Superposition and Thevenin's theorems. When a complex network is reduced to a single voltage source with a known internal impedance, cut-and-try isn't necessary. 73

QRX

continued from page 8

can be reached. To contact Hollingsworth concerning enforcement, E-mail [rholling@fcc.gov] or call (717) 338-2502.

On another front, Hollingsworth has also made good on his well-publicized promise to issue the worst offenders a final warning to clean up their act. Those letters went out on January 8th. What impact the letters and Hollingsworth's on-the-air appearance will have is too early to assess. The one thing it does say is that there's a new FCC in town and the bad boys of ham radio had better beware.

Tnx and a "we'll be good" to *Newsline*, Bill Pasternak WA6ITF, editor.

Enforcer II

The FCC's Riley Hollingsworth K4ZDH is making his list and checking it twice. Now that he knows which hams are naughty, not nice, he's ready to take action against flagrant amateur offenders.

"Fully half of the amateur problems on HF relate to a specific group of jammers by malicious interferers who enjoy disrupting as much amateur communication as possible," said Hollingsworth, the FCC's point man for amateur enforcement within the Compliance and Information Bureau. "Enforcement action against this group is long overdue."

Hollingsworth has prepared a report to his boss, CIB Chief Richard D. Lee, detailing his findings and fingering the most serious violators in a "Top Ten" list which he declined to make public just yet. His memo urged "immediate enforcement action."

Hollingsworth said he's talked with more than 250 people on the amateur enforcement line, (202) 418-1184, since the end of September 1998, when the FCC's latest amateur enforcement initiative kicked into high gear. In addition, he has received more than four dozen letters and E-mailed comments concerning problems in the Amateur Service. Hollingsworth has concluded that, while most amateurs abide by the rules, a few habitual offenders continue to flout the law. "We are not going to stand to be further degraded or destroyed by them," he said.

Hollingsworth says that jamming and deliberate interference is the most common problem, accounting for 31% of all complaints. Repeater misuse and jamming account for another 29%. But he considers the HF abuses, most typically reported on 75 and 20 meters, to be the more serious offenses because they can be national or international in scope. Other general problems accounted for another 17% of the complaints, said Hollingsworth. A full 10% of complaints concerned an unlicensed individual in California who already has spent time in jail for past convictions.

Hollingsworth has sent out 30 informal "warning letters" to individual operators as a result of complaints. The letters warn the recipients that a complaint has been received about the recipient or someone using his or her callsign and indicate that the allegations, if true, could jeopardize the amateur's license and request the recipient to contact the FCC to discuss the matter.

"In almost every case, the recipient has contacted us," he said. "In one case the licensee contacted us, apologized, and reports since that time indicate that the licensee has became a model operator." Some amateurs have reported to the ARRL that amateur behavior has improved, dramatically in some areas, since word hit the street that the FCC was taking amateur enforcement seriously. For its part, the League has said it is willing, for now, not to pursue its request to further privatize amateur enforcement.

Hollingsworth says the warning letters will continue, but now he's taking aim at the hardcore scofflaws within the amateur radio community. "We have now let everyone out there know we're back," he said. Continued violations will "guarantee" license revocations, fines, or in extreme cases, equipment seizures.

"Church is out now," he said. "We mean business and we're strapped in and ready to ride." Hollingsworth added: "Amateur Radio rule-breakers continue these violations at their own risk."

From KD4VBI:

Tough talk for a government official. I hope it isn't a paper tiger. We have heard tough talk before but what happened? Nothing but talk.

For example, my friend AD4PS, Dennis Hamilton, who is a high ranking R.A.C.E.S. officer, a fine ham, and an asset to the amateur community, tried his hand at tough talk toward a horrific non-licensed jammer. What did it land him? He is now under investigation by the very agency he works for.

This maggot of a jammer is well known to the amateur and the county as a culprit who interferes not only with amateur transmissions but also with vital county communications such as fire rescue and the Trauma Hawk medical helicopters—which can mean the difference between life and death.

Yet when AD4PS said this person was jamming a communication (amateur) over the air, this misfit lawbreaker made a complaint to the county against AD4PS that put his butt in a sling.

Now he is not only sweating the stigma of an investigation, but now his job hangs in the balance.

You tell me where the justice begins and the injustice ends in this case. Is it OK to commit a crime but not OK to say who the criminal is?

Does justice mean only just us?

Tnx and an "honest we will" to *The ARRL Letter,*

Continued on page 57

Above & Beyond

VHF and Above Operation

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Frequency extension of test equipment to 24 GHz

This time, let's cover some very useful test equipment to assist you in functioning at 24 GHz. This clever surplus material consists of equipment that can be obtained at lower frequencies for use as actual test equipment at 24 GHz. As most of you know, there is very good test equipment available for 24 GHz, but it is still in the hands of commercial labs. Most of the equipment in amateur hands seems to top off at 18 GHz.

The column this time will describe some surplus material that was assembled to form a testing vehicle at 24 GHz. You are probably in a similar fix in that my test bench does not go above 18 GHz. This seemed to be a hindrance to further exploration of our 24 GHz and above microwave bands. We were out quality testing equipment on these higher microwave bands to see what was happening.

This project to enhance our ability at 24 GHz and possibly even higher is the method we use in the San Diego Microwave Group to adapt our existing lower frequency test equipment to function at 24 GHz. What was needed was a circuit to test both as a spectrum analyzer to look at transmitter signals and a signal source for receiver testing.

The circuit that Kerry N6IZW came up with will function at 24 GHz and allow testing in the transmit spectrum analyzer as well as provide testing on the workbench. While this conversion process is quite accurate as to frequency for both receive and transmit, it does leave some uncertainty in the dBm reference level department.

This converter allows existing low frequency test equipment to be put to use on 24 GHz. Those pieces of test equipment to go beyond 18 GHz do so with the penalty of requiring external mixers that are no longer with the equipment. Coupling this to the increased problem of using the high multiple numbers of harmonics used with these mixers makes correct signal identification difficult.

This problem is universal even on my workbench, which stops functioning at 12 GHz for spectrum analyzers and 18 GHz for sweep signal generators. Sure, the old 8551 HP spectrum analyzer goes up to 40 GHz, but because it uses such high order harmonics and mixing schemes it doesn't provide good data for frequency setting—it's just too vague even with a surplus external mixer. So what can you do to make it function as you would wish and display 24 GHz with good frequency accuracy?

Well, Kerry N6IZW came up with a solution for our microwave group and it works quite well. It does require a few parts to make the unit function. The two major components are a Frequency West brick oscillator at some output frequency in the 11.5 to 12 GHz range, and a very good quality coaxial connectorized microwave-rated mixer. The mixer we used is rated RF-wise to 18 GHz and performs well to 24 GHz. The remaining components include an attenuator to reduce the brick oscillator to +7 dB for local oscillator injection to the mixer, and an SMA-to-24 GHz waveguide transition.

Confused? Let me put you on the right track. We are going to use a low-order harmonic, namely the 2nd harmonic of the 12 GHz brick oscillator as the 1/2 frequency local oscillator injection to the mixer. The second harmonic, along with the fundamental (12 GHz) frequency of the brick LO is injected to the LO port of the mixer. An SMA attenuator is included in this path to reduce the brick oscillator microwave oscillator output to a maximum of +8 dBm. That is the local oscillator injection maximum rating for the mixer we used.

The mixer we selected is one that is rated to 18 GHz for the RF and LO port. It happens to be an SMA coaxial double balanced mixer from Watkins Johnson, part #W-M80. Its specifications are as follows: for the RF and LO port, frequency range 6 to 18 GHz; IF port, DC to 3 GHz. Conversion loss is in the 6 dB range. This mixer, while rated to 18 GHz, still performs at 24 GHz with increased conversion loss at 24 GHz. I don't have the equipment to measure the actual conversion loss at 24 GHz and suspect it is in the 10 dB or so range. Even with excessive conversion loss it works very well.

The goal of this project was to construct a device that would allow accurate measurements to be made at 24 GHz with material on hand. With the exception of the mixer, all other parts were on hand on our workbench. The converter has proven to be quite functional, and has allowed us to put to good use a lower frequency spectrum analyzer for seeing translated frequency and setting our equipment at 24 GHz. It has proven to be quite accurate, even for SSB operation at 24 GHz, by removing frequency ambiguity using a synthesizer-based frequency source. In testing with wideband systems, it performed equally well. Here is how this 24 GHz conversion system functions.

With 1/2 local oscillator injected to the mixer's local oscillator port (LO) (let's say, for simple argument 12 GHz), the second harmonic would be 24 GHz. That's a local oscillator injection of 12 GHz and 24 GHz (second harmonic). The RF port is coupled to a 24 GHz transition to be used as an antenna at 24 GHz. The waveguide also forms a wideband filter rejection of 12 GHz products.

The IF port of the mixer is connected to the spectrum analyzer input. The analyzer acts as a sensitive receiver with a visual display for input RF. It is capable of seeing products of the mixing operation and displaying them on the o-scope of the analyzer. The center line of the analyzer can first be calibrated to frequency by injecting a signal generator set to exactly the frequency expected for reference. Well, with RF at (hopefully) 24.155 GHz, a wideband frequency and the LO's second harmonic at 24 GHz, we mix off the 24 GHz of the 24.155 GHz, leaving a 155 MHz signal output on the IF port.

With the analyzer setup, RF is detected from the 24 GHz (frequency unknown at this time) Gunn transmitter by the waveguide transition and mixed with 24 GHz, producing a signal presentation on the o-scope. Without readjusting the scope on the analyzer, adjust the Gunn cavity frequency adjust screw for center frequency alignment on the spectrum analyzer. When this is done at the previously calibrated 155 MHz marker from the signal generator, you can be assured that the Gunn transmitter is now on 24155 MHz to your calibration accuracy.

While this scenario is true, it is better to use a less troublesome IF frequency depending on what you can come up with. A 12 GHz source sounds nice but is usually not in the cards. Sources with unusual frequencies such as 11.978 GHz will work fine. The exact frequency is not important, as long as it's a near even number to handle. Multiply the local oscillator frequency used by two and subtract the desired frequency on 24 GHz, and that's your IF frequency.

Just keep it in the mixer's IF frequency limit of less than 3 GHz for the mixer I used, the W-M80. Other mixers might have IF frequency ranges with different maximums and minimums. Verify what mixer port operation you have.

Using a higher IF frequency should reduce most unwanted spurious responses to a minimum, making the major signal the correct one on the spectrum analyzer. If you are sure which response is correct, this should not be a problem. If you calibrate the spectrum analyzer screen, you can make, say, 10 MHz per division and see if your system can tune to the other wideband frequency that is 30 MHz lower at 24.125 GHz.

To verify the desired 24 GHz frequency on your spectrum analyzer, adjust your signal generator to the IF frequency and calibrate the center line display of the analyzer to it. Check the signal generator accuracy with your frequency counter. In the scenario described above, we used a 155 MHz IF for 24155 RF. Now, for 30 MHz lower, use 125 MHz or 30 MHz less than our IF frequency to display 24125 MHz center frequency on the spectrum analyzer (with 12 GHz exactly the LO inject frequency to mixer).

With the frequency stability of the brick-type oscillators rated at a few kHz or even tens of kHz, this is of little problem in reference to 24 GHz wideband measurements. With Gunn oscillators, even non-varactor types, voltage tuning can be made over a few MHz at minimum, making an error of 100 kHz nothing to worry about. Do you need a brick at exactly 12 GHz? Certainly not. We only need a frequency out of the brick that is reliable. For example, I found a couple of bricks that came with 111.4768 MHz crystals in them. Ten to 12 GHz brick oscillators operate on the 102nd, 108th, or 114th harmonic of the phase-lock crystal—in this case, 111.4768 MHz.

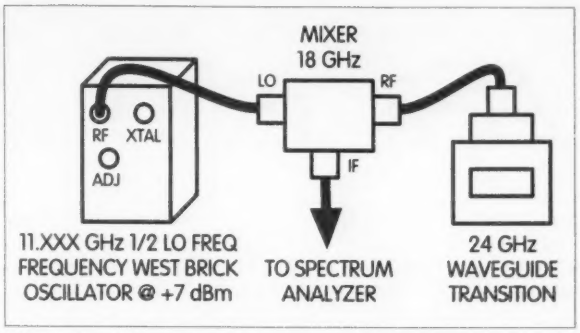

Fig. 1. Block diagram of frequency extension equipment for using low frequency spectrum analyzers to display accurately 24 GHz frequency information using low order harmonic. System uses 1/2 frequency local oscillator and mixer originally made for 18 GHz operation. 24 GHz filtering done by 24 GHz antenna transition using waveguide cutoff for broad filtering.

The 102nd harmonic is 11.370 or 22741.267 minus 24155 MHz = 1413.7328 MHz on the IF port. The 108th harmonic lock is 24078.989; I made a slight adjust in the crystal to make it lock at 24079 MHz, verifying the crystal frequency at 111.47685 MHz and making the IF output 76 MHz, for an operation frequency of 24155

New Digital Frequency Lock
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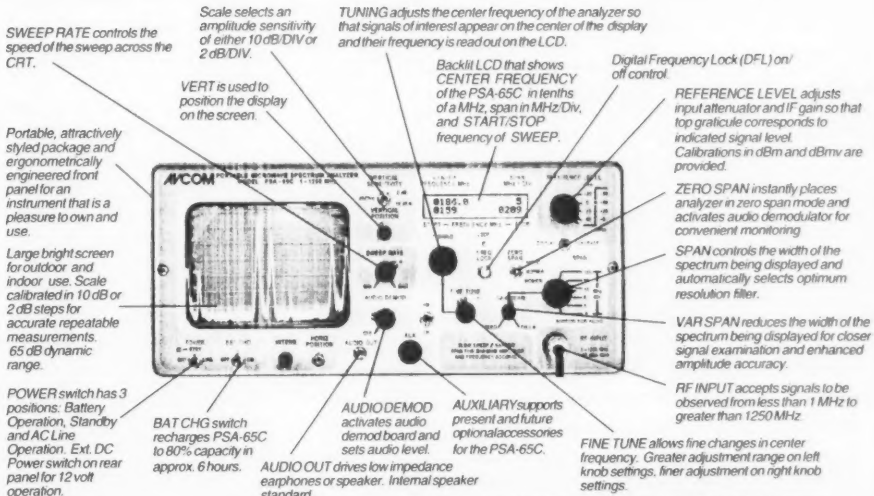
***Made in U.S.A.**

AVCOM's newest Portable Microwave Spectrum Analyzer, model **PSA-65C**, has an expanded frequency range from less than 1 MHz to 1250 MHz, for the amazing price of $ 2930.

AVCOM's new **PSA-65C** is a low cost general purpose spectrum analyzer that's loaded with standard features including FM audio demodulator, AM detector and digital frequency lock. The **PSA-65C** covers frequencies thru 1250 MHz in one sweep with a sensitivity greater than -95 dBm at narrow spans. The **PSA-65C** is ideally suited for 2-way radio, cellular, cable, satellite, LAN, surveillance, educational, production and R&D work. Options include new 1250 MHz frequency extenders, BNG-1000A tracking (noise) generator, log periodic antennas, carrying case (AVSAC), and more.


SWEEP RATE controls the speed of the sweep across the CRT.
Scale selects an amplitude sensitivity of either 10 dB/DIV or 2 dB/DIV.
TUNING adjusts the center frequency of the analyzer so that signals of interest appear on the center of the display and their frequency is read out on the LCD.
Digital Frequency Lock (DFL) on/off control.
VERT is used to position the display on the screen.
Backlit LCD that shows CENTER FREQUENCY of the PSA-65C in tenths of a MHz, span in MHz/Div, and START/STOP frequency of SWEEP.
REFERENCE LEVEL adjusts input attenuator and IF gain so that top graticule corresponds to indicated signal level. Calibrations in dBm and dBmv are provided.
Portable, attractively styled package and ergonometrically engineered front panel for an instrument that is a pleasure to own and use.
ZERO SPAN instantly places analyzer in zero span mode and activates audio demodulator for convenient monitoring
Large bright screen for outdoor and indoor use. Scale calibrated in 10 dB or 2 dB steps for accurate repeatable measurements. 65 dB dynamic range.
SPAN controls the width of the spectrum being displayed and automatically selects optimum resolution filter.
VAR SPAN reduces the width of the spectrum being displayed for closer signal examination and enhanced amplitude accuracy.
RF INPUT accepts signals to be observed from less than 1 MHz to greater than 1250 MHz.
POWER switch has 3 positions: Battery Operation, Standby and AC Line Operation. Ext. DC Power switch on rear panel for 12 volt operation.
BAT CHG switch recharges PSA-65C to 80% capacity in approx. 6 hours.
AUDIO DEMOD activates audio demod board and sets audio level.
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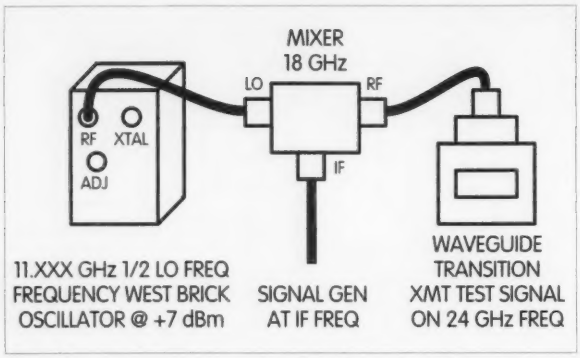

Fig. 2. *Nearly same circuit as in* ***Fig. 1****, but instead of displaying signal being transmitted from 24 GHz unit on spectrum analyzer, change IF port of mixer to signal generator. Now you have modified the original circuit to be a very accurate weak source signal generator on 24 GHz for receiver testing.*

again. There are lots of possibilities—just whip out a calculator and see what you can turn up. It's better to use a higher frequency IF. We found that 1296 MHz or some nearby frequency worked best.

The display on a spectrum analyzer is easy to set as long as you have accurate signal generating equipment and a frequency counter in the 2 GHz range to verify the brick and signal generator frequencies. By mixing down to lower frequencies in this way, we have enabled easy frequency markers to be compared with accurate signal generators and verified with a frequency counter our nearly exact frequency of operation on 24 GHz. Not bad for just a simple bunch of parts bolted together.

24 GHz signal generator

You might have guessed by now what comprises the signal generator setup to verify receiver operation on 24 GHz. Well, it's almost the same connections as for the spectrum analyzer, with one exception. Disconnect the spectrum analyzer and connect the signal generator at the IF port, and now you have turned the brick oscillator mixer into a transmitting converter.

Assume we have just calibrated the Gunn oscillator at 24155 MHz. We are using a 30 MHz IF frequency for the FM receiver, so we need a frequency that will mix with the 24155 MHz transmitter to produce a product 30 MHz lower in frequency. With the signal generator set to maximum output (no more than +7 dBm) and a frequency of 155 – 30 MHz, or 125 MHz, you should hear on your wideband FM receiver a faint but noted signal source. You can use this for peaking up receiver performance and evaluation purposes. For SSB operation, the converter performs excellently.

The signal generator's output is not a fire-breathing dragon but a very detectable accurate signal source for workbench evaluation. It's uncalibrated in actual dBm, but still very useful for determining system operation and some weak signal testing.

When selecting a local oscillator frequency (in the 11 to 12 GHz range), make sure it's high enough to allow a quality signal generator to function along with the source. Also, don't exceed the IF frequency specifications of the mixer port. It doesn't matter what frequency you use—just select one that is easy for you and your existing test equipment. Even some brick oscillators that came with crystals to control the phase-locked brick oscillator frequency could be quite fractional and are just as usable for this purpose. The difference with very fractional numbers is that you will have to use a calculator, unneeded with simple even numbers. A minor arithmetic problem but still very usable. You could in any case possibly make a minor adjustment in the exact crystal frequency to put it on a rounded off frequency for simpler problem solving. My suggestion is to adjust very weird crystals to a frequency more pleasing to your application.

Well, there you have it: both a receive and transmit accurate frequency marker, allowing you to extend the capabilities for your lower frequency test equipment. This technique is quite adaptable even to higher frequencies, although I have not given it a try. We are trying to locate equipment for communications on 47 GHz, the next higher microwave band, but for now this is only a part-time scavenger mission.

A couple of ideas in closing, aimed particularly at the microwave antenna. Most first tries can be made with a modest horn antenna that could be fashioned from hobby copper or brass. The gain of such a small horn antenna is in the 12 to 15 or so dB range. However, when coupled with and using the small horn to illuminate a dish of about 12 inches in diameter, the dish provides some 35 dB of gain to the system. Quite cheap in terms of simple gain. Another thing to take into consideration when using dishes at 24 GHz is that for a dish in the 30- to 36-inch class, the gain goes up into the 44 dB range—quite impressive, but at a cost.

The cost for such high gain with a 3-foot dish is in the beamwidth of the radiated or detected signal. The beamwidth will be less than one degree of compass, making accurate pointing quite important. With such a sharp beam pattern, it might be too rough to find signals.

On the other hand, using a 1-foot dish, the pointing angle is increased to slightly over three degrees, making finding a signal much easier than when using a 4-foot dish. Sure, you only get 35 dB gain with the 1-foot system, but it's not a monster to point. Besides, it can be stored very easily in an apple box, and you don't have the handling problems you would with a much larger dish. These are points you should take into consideration when putting your system together.

Just consider the tripod and supporting structure to make a dish stable with a mild wind. The stress factors with a 4-foot compared to a 1-foot dish are substantial. Considering mountings for a 1-foot dish, use a camera tripod for reasonable use and a heavier tripod for best stability. For the 4-footer you might have to carry around several batteries and concrete blocks to firm up most standard heavy-duty tripods. We suspend batteries or other heavy objects from the center mount of the tripod to provide a rigid mount for the dish and tripod structure.

Well, that's it for this month. Hope you have had as much fun in putting together your microwave system as I have. Best 73 for now, Chuck WB6IGP. 73

If you're a No-Code Tech, and you're having fun operating, tell us about it! Other No-Code Techs will enjoy reading about your adventures in ham radio—and we'll pay you for your articles. Yes, lots of nice clear photos, please. Call Joyce Sawtelle at 800-274-7373 to get a copy of "How to Write for *73* Magazine."

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HAMSATS

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

When Tony England WØORE went to orbit on STS-51 on July 29, 1985, he took the usual SAREX (Shuttle Amateur Radio EXperiment) gear for two-meter voice contacts, but he also included some exciting extras. He had a complete two-way SSTV (Slow-Scan TeleVision) station. SSTV has been around for 30 years. It is a communications mode that sends and receives images using standard audio bandwidth. The signals can be put into a rig via the microphone jack and received through the speaker or headphone connection. SSTV had been used via OSCARs (Orbiting Satellite Carrying Amateur Radio) many years before Tony's trip, but this was the first time for two-way SSTV activity between a space-based ham and those on the ground.

The STS-51 SSTV gear consisted of a SAREX-modified Motorola MX-340 HT, a window-mounted two-meter antenna, Panasonic camera and monitor, Robot 1200C SSTV scan converter, Sony tape recorder and a custom headset. The gear worked well and those with appropriate equipment could receive and view pictures from the shuttle. At the Johnson Space Center in Houston, Texas, a group photo of the astronauts' wives was sent to the shuttle via SSTV. Tony captured the color image and resent it back to earth. The wives had made a round trip to space and back. Those monitoring the two-meter downlink saw this picture along with the many others sent from Tony and the crew.

Only a year after Tony England's ham activity from the space shuttle *Challenger*, the first major component of the Soviet *MIR* space station achieved orbit. Within two years, a full-time, two-meter ham station was onboard. Later, with the addition of a packet terminal node controller (TNC), signals from *MIR*—either voice or digital—were a daily event. *MIR* had an outside antenna and could run more power than the space shuttle. Signals were excellent.

Today on the *MIR* show

A few years ago, a group of hams got together to discuss the possibility of getting SSTV onboard *MIR*. They included Don Miller W9NTP, Farrell Winder W8ZCF, Hank Cantrell W4HTB, Dave Larsen N6CO and Miles Mann WF1F.

In June 1998, Miles Mann arrived in Moscow with three complete SSTV systems for delivery to Energia, the Russian organization that built *MIR*. Six months later, in December, the SSTV system was in orbit and on the air. Miles represents a group called MAREX-NA (Manned Amateur Radio Experiment—North American Division). This organization was created a month earlier as it split off from MIREX (*MIR* International Radio Experiment). According to Miles, MIREX handles QSL cards and some system operator duties, while MAREX-NA builds and flies amateur radio projects for the Russian space station. Information about MAREX-NA can be found on the Internet at [http://marex-na.org/].

The *MIR* gear

The *MIR* SSTV system is very compact and functional. It consists of a stack of electronic devices including a TASCO SSTV system with a color LCD (liquid crystal display) screen, a Kenwood dual-band (two meter and 70 cm) TM-V7A mobile FM transceiver, a custom controller box, an infrared remote control unit and an Apple Computer CCD (charged coupled device) color TV camera. The system is capable of

Photo A. *Slow-Scan TV from* MIR *with Soyuz TM-28 crew. Gennadiy Padalko (flight engineer) and Sergei Avdeyev (flight commander).*

Photo B. *A chocolate bear floats in front of the SSTV camera for a shot in December.*

Photo C. *The MIR-26 mission logo as seen via SSTV from* MIR.

Continued on page 44

***Photo D.** With the camera aimed out the window, great views of Earth have been sent via SSTV from* MIR.

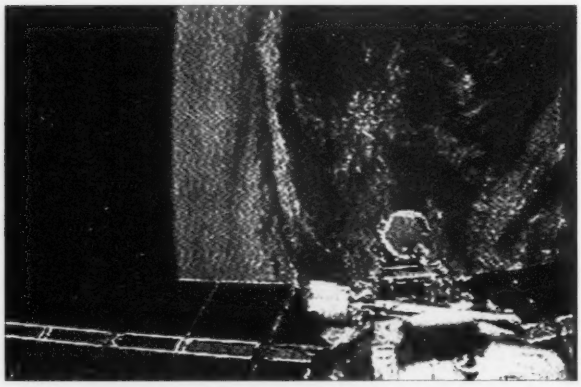

***Photo E.** Solar panels in the foreground and the Earth in the background, as sent from* MIR *in Robot-36 SSTV.*

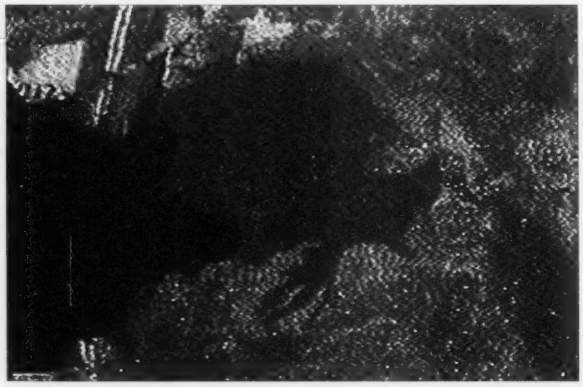

***Photo F.** A good shot of upper Lake Michigan as seen from* MIR *on a south-to-north daytime pass over North America.*

HAMSATS

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manual or automatic operation and can be used to receive as well as transmit SSTV.

In the automatic transmit mode, the system is set to snap a picture once every two minutes and transmit it with a CW identifier of RØMIR just before the first sync signals. This means that there are about 80 seconds of dead air between pictures. This is the predominant mode of operation and is usually run with the Apple camera aimed out a window, providing spectacular Earth shots during daytime passes. At night you get solid blackness unless the crew has aimed the camera at something inside *MIR*.

The primary operating mode for *MIR* SSTV is "Robot 36." This is the same mode that became highly popular during STS-51 in 1985. It is one of the color formats designed by Robot. The picture transmission takes 36 seconds to form a complete 240-line color image. Image quality is good, but this is not one of the more advanced SSTV formats. *The ARRL Handbook* carries a good description of how SSTV works and definitions of the many modes currently in use.

The Robot 36 mode sends luminance and chrominance information in each horizontal line of the picture. This format is compatible with older black-and-white systems and provides a reasonably easy to receive and decode signal. It has been a popular format for SSTV operation via the hamsats for many years.

Receiving *MIR* SSTV

Due to various RF cabling problems on *MIR*, the SSTV signals have had to share time with the usual packet activity on 145.985 MHz. Originally, the SSTV was supposed to use 437.975 MHz. If time allows for *MIR* cabling changes, SSTV may yet be found on this 70 cm frequency, but for the first few months of operation, two meters was used exclusively. While packet proponents have voiced their complaints, the new crew of SSTV enthusiasts has been delighted with the results. Packet has been on predominantly during the week, with SSTV on the weekends. Doppler shift on 70 cm is three times worse than that on two meters, so pictures are easier to collect on the lower frequency.

A simple omnidirectional vertical antenna (like a ground plane) can be used in conjunction with a standard FM scanner to pick up the SSTV signals from *MIR*. A good two-meter transceiver with a rotatable beam will do better, but many fine pictures have been received and viewed on minimal systems.

It is best not to decode the signal while *MIR* is passing by, but instead to record the strange audio tones during a pass, and then decode them afterwards. During STS-51, it was common to collect images on cassette recorders for later playback. Today you can do a much better job if you have a hi-fi VCR. Connect a good quality video signal into the external video jack. You can get this from a TV with a video output connection or another VCR set up in a similar fashion. Connect the audio from your scanner or two meter radio to the left external audio input on the hi-fi deck. Set the VCR to SP (Standard Play) mode and hit record when *MIR* signals are detected, usually by watching the TV that now has your radio signals coming out of the speakers. Using a low-power HT, you can annotate the process by transmitting on the *MIR* downlink frequency between pictures. You can identify things like the time and calculated latitude and longitude of *MIR* on the tape to help identify the pictures.

Decoding *MIR* SSTV

In 1985, it was an expensive proposition to set up a home station for color SSTV reception. A Robot 1200C scan converter was needed to get good pictures. This could cost over $1000. Some simple software had been developed to decode black-and-white pictures on PCs of that time, but the results were rather dismal. The audio SSTV signal was typically connected to the PC via the cassette input jack. The resultant picture was quite grainy and hard to discern.

Today there are many ways to view SSTV. One is to get a TASCO scan converter like that on *MIR*. Most units cost about $400. Another is to use the

HOMING IN

Radio Direction Finding

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Photo A. Kevin Hunt WA7VTD (center) and Dick Fredrickson WAØDIM (right) congratulate Southern California foxtailer J. Scott Bovitz N6MI at the closing banquet of the first Portland Friendship Games in 1991. Kevin and Dick are still officers of FARS, which is putting on FRG-99 and the Region 2 ARDF Championships.

Dayton, Portland, and South Texas

Is hidden transmitter hunting the fastest growing activity in ham radio? I don't know for sure, but if my correspondence log is any indication, it's getting more popular every month. More and more hams are discovering the fun of on-foot international-style foxtailing (also called radio-orienteering or ARDF) and traditional mobile radio direction finding (RDF) contests (T-hunting or bunny hunting). Whichever type of transmitter hunting you prefer, there's lots of news for you this month.

The 1999 Dayton Hamvention's Fox Forum promises to be the best ever. Here's your chance to meet with RDF enthusiasts from all over the country. This year's organizers are Dick Arnett WB4SUV, Bob Frey WA6EZV, and Jim Elmore KC8FQY. Beginning at 10 a.m. on May 15 (time subject to change), a three-ring circus of foxhunting will feature Joe Leggio WB2HOL discussing his home-brew RDF equipment projects, followed by yours truly's slide show on mobile T-hunting, California-style. Then Dale Hunt WB6BYU will describe the excitement of international-style foxhunts, from last year's World Championships to the upcoming multi-nation event in Oregon.

The fun resumes after lunch, when it will be time for you to chase radio foxes for fun and prizes. Dick, Bob, and Jim aren't saying much about what to expect, except that it will be a challenge to both new and experienced RDFers. Bring your on-foot two-meter RDF gear to use and your mobile T-hunt setups to show off. I'll have my camera.

Crowning champs in the Beaver State

Preparations are in full swing for the upcoming biggest radio-orienteering event in the Western Hemisphere. Never before have hams in so many countries made plans to compete in a foxhunt on US soil. The first International Amateur Radio Union (IARU) Region 2 ARDF Championships will be part of the sixth biennial Friendship Radiosports Games (FRG-99), sponsored by the Friendship Amateur Radio Society (FARS).

I have explained the rules of radio-orienteering many times before, so here are just the basics for new readers: Five "fox" transmitters are placed in a large, woodsy park. They are all

---

sound card in your computer in conjunction with appropriate software to capture the images. A good list of available options, both hardware and software, can be found at: [http://www.ultranet.com/~sstv/download.html]. A favorite among *MIR* SSTV chasers has been Windows 95 SSTV (W95SSTV). A shareware version can be found at: [http://www.siliconpixels.com/W95SSTV/W95SSTV.HTM].

Most of the photos here were decoded with this software, using a reasonably current Pentium clone computer and a Sound Blaster-compatible sound card. The program is very easy to use even without reading all of the instructions. Jim Barber N7CXI and Bill Montgomery VE3EC did a really nice job. The software can be used on many SSTV modes and is capable of transmitting in addition to receiving SSTV. If you like the software, be sure to support the authors by registering your copy.

SAREX, SAFEX, MIREX, MAREX

Some confusion has been evident in hamsat circles regarding the state of manned spacecraft ham activities due to the growing numbers of players. SAREX is the Shuttle Amateur Radio Experiment group that was responsible for hams in space starting with W5LFL on STS-9 in 1983. They have been instrumental with activities involving school contacts with astronauts for many years. The group is still very much alive and is working closely with NASA, AMSAT and several related groups around the world to put serious ham radio on the International Space Station (ISS). Their project is appropriately named ARISS or Amateur Radio on the International Space Station.

SAFEX made its space debut as DPØSL in October 1985 on STS-61. DD6CF, DG2KM and PE1LFO operated a dual-band (two meters and 70 cm) system from the German SPACELAB module in the cargo bay of the space shuttle *Challenger*. SAFEX has been responsible for a number of shuttle and *MIR* experiments over the years.

MIREX and MAREX are relative newcomers. MIREX has been responsible for packet system advances on *MIR* and the scheduling of contacts and activities involving the *MIR* crew, school groups and others. MAREX has made great strides with the popular SSTV operation on *MIR*. Whether all the groups will be able to work together to advance ham efforts on manned spacecraft is unknown. In the meantime, we do know that what we now have in orbit is a limited resource. The crew on *MIR* was changed in late February. *MIR* is scheduled to be vacated in July if no funding is available to keep the orbiting outpost running. The Russian space station would then be brought back to Earth, rather violently, in August. Collect pictures while you can! 73

on the same frequency, transmitting in turn for 60 seconds each. One after another in rotating sequence, they send a simple Morse message. You don't have to read the code to figure out which fox is on the air, because you can simply count the number of dits in the repeated message.

Your mission is to go to each fox, punch your orienteering card with the unique punch you'll find there, and then get to the finish line first. If you take too long (the limit is about two hours), you not only don't win, but you are disqualified. The shortest route varies greatly, depending on the size of the venue. For the Region 2 Championships, it will be between 2.5 and 4.5 miles.

Besides the age 18-to-40 (Seniors) division for men, there are special age divisions at most formal ARDF events for Old-Timers (men ages 40 to 55) and Veterans (men ages 55 and up, regardless of military service). Of course, Juniors (males under age 18) have their own division, too. IARU leaders are discussing a proposal to have four corresponding age divisions for women, but right now there is only one division for all females. In regional and world championship foxhunts, the Juniors, Old-Timers, Veterans and Women need to find only 4 of the 5 fox transmitters.

If you are selected for Team USA 1999, you will vie for medals against foxtailers from Canada, eastern Russia, and Japan, Other countries that are likely to send teams include Bulgaria, France, Norway, Sweden, western Russia, Moldova and the Ukraine. The most formidable competitors are likely to be on the team from Moscow, which placed either first or second in every age/gender division in the two-meter event at the last ARDF World Championships.

The Ukrainians also had a very strong team at the 1998 championships, taking gold in the Women's Division and bronze in every other division. Scandinavian ARDFers are very good, too—especially the older ones. Norway took fourth place and Sweden took fifth place in the Veterans Division last year.

Although there has never been an IARU ARDF championship event in North or South America before 1999, FARS has had lots of experience. It started in 1989, when a small delegation of Portlanders traveled to Khabarovsk, Russia, a sister city to Portland, for a week of home stays, touring, and radiosport competitions. They were joined by hams from Niigata, Japan, another sister city. There were contests in on-air DXing and CW sending/receiving, and a two-meter foxhunt. None of the Portlanders had ever tried RDF in the woods before, but they enjoyed it.

When it was their turn to host the Russians and Japanese two years later, FARS-Portland connected with southern California T-hunters and put on a great foxhunt. A sister city delegation from Victoria, British Columbia, joined FARS and hosted the Games in 1993. They cleverly enlisted help from the Vic-Orienteers, a local orienteering group, to make their foxhunt a premier event. Russians and Japanese hosted the Friendship Games in 1995 and 1997, respectively, with the foxhunt again a major event each time.

The Games return to Portland this year. Many of the original organizers will be in charge, including Kevin Hunt WA7VTD, general counsel of FARS-USA and secretary of FARS International (**Photo A**). Others are relative newcomers, such as Foxhunt Committee Chairman Dale Hunt WB6BYU of Yamhill, Oregon.

Dale, who is not related to Kevin, is no stranger to ARDF. He competed at FRG-97 in Japan, where he finished first among all entrants from North America. Then he led the USA's delegation to the ARDF World Championships in Hungary last September (see "Homing In" for January 1999). He continues to serve on the international committee that is reviewing and revising IARU's championship foxtailing rules and procedures.

For kids of all ages

When we think of radiosports, an image of teenagers and young adults comes to mind. But that's no excuse for the rest of us to shy away. You don't have to be an athlete or a marathoner. "Homing In" has told tales of gold medalist ARDFers bagging five foxes in 45 minutes on an 8-kilometer course (about a 9-minute-per-mile pace). But that's the exception, not the rule. The median times (half faster, half slower) for the two-meter hunt at the last World Championships ranged from 75 minutes for Old-Timers to 95 minutes for Veterans.

That's right, the middle-aged men did better than youngsters at finding their required 4 foxes! And 19 minutes per mile sounds much easier, doesn't it? It's often possible to briskly walk the course and still finish in plenty of time, if you are efficient at RDF. You can do that, can't you?

The two-meter hunt in Oregon on August 11 will probably attract the most interest from North American foxtailers, but don't miss the opportunity to try 80 meters the next day. Radio-orienteering on that band is a bit different, but just as much fun. In some countries, such as Sweden, almost all foxhunts are on 80. The Swedes run through thick forests during rain, snow, or sun, carrying cigarette-pack-sized receivers with ferrite rod antennas that don't snag the thick vegetation like a two-meter beam or quad does.

Small air-core loops are popular in other countries, such as Russia. In either case, better accuracy is obtained by utilizing the antenna pattern's sharp null instead of its broad peak. A little "sense" wire creates a cardioid (heart-shaped) pickup pattern to eliminate the ambiguity of a bare loop antenna, which has two nulls 180 degrees apart (a figure-8). Equipment for this band is easy to build. You may even be able to modify an AM transistor radio to work there. Experimenters, here's your chance to innovate!

Whether you are an expert foxhunter, a weekend jogger, an orienteering fan, or just want to see foxtailers in action, plan to be in Portland during the second week of August. Want to know more about the rules and suitable equipment? See the "Homing In" Web site or check your *73* back-issue library for my columns in the January 1998, June 1998, and January 1999 issues. You can read all about what it's like to attend previous Friendship Radiosport Games in the September 1991, October 1993, and January 1996 issues.

There will be more about preparation for the championships in upcoming "Homing In" installments. But don't put off registering. FARS needs to know how many hams are coming, and I need to plan the makeup of Team USA. If lots of stateside hams sign up, we may need to hold a qualifying event or find another way to allocate the limited number of available slots. There's an application form for Team USA at the "Homing In" Web site. Download it, fill it out, and send it in to me via E-mail. Make paper copies of the form to hand out at your local foxhunts. Completed paper copies can be mailed to my postal box listed above. If you're not on the Internet, send a self-addressed stamped envelope to me and I'll send back a form for you to fill out and mail.

To compete for a country other than the USA, contact your country's ARDF Coordinator or national society headquarters. ARDF Coordinator for the Canadian national society (Radio Amateurs of Canada) is Perry Creighton VE7WWP. His E-mail address is [ve7wwp@rac.ca].

Don't leave out your family. Most ARDF Team USA members will be amateur radio operators, of course, but a ham

ticket is not required for participation in this event. Let others in your family try out your ARDF equipment as you practice. Maybe they will decide to join in the fun. Tell your local orienteering club about it, too.

It's not too early to start making your travel plans. If you're arriving by air, WB6BYU reminds you: "Book to Portland, Oregon (PDX). The other Portland is almost 2500 miles away!" Save airfare dollars by planning a Saturday night stay, arriving on August 6 or 7. There will be practice and training events on August 9 and 10, followed by competitions on the next two days. The closing banquet will be August 13.

As the weather warms up, it will be time to hold radio-orienteering practice sessions in your home town. How about packing a picnic or grabbing some takeout food and heading to a local park for a couple hours of foxhunting on Sunday afternoons? That's what members of the Super System 440 MHz repeater group have been doing lately (**Photo B**). Let everyone take a turn at planting the transmitters and trying out the RDF gear. As strong competitors emerge, encourage them to do additional training for participation at the Portland championships.

Where'd the owls go?

Thanks to the many readers who responded to my plea for volunteer monitors to assist the Burrowing Owl Project. (See "Homing In" for August 1998.) There is no way of knowing exactly how many hams and scanner enthusiasts listened in the 172 MHz range for the collar transmitters during the southward migration and wintering period of the 41 banded Saskatchewan and Alberta owls. Unfortunately, the birds have been elusive to both hams and the Canadian biologists.

One of the volunteer hams, Grier Garrick KC5FJZ of Rockport, Texas, was first to report a pulsed signal on 172.370 MHz on 22 November. A radio collar on that frequency had been attached to a juvenile burrowing owl at a farm about 5 miles east of Moose Jaw, Saskatchewan last summer. The Rockport signal disappeared before it could be verified and tracked down. "Cactus Charlie" Hoffman K5SBU has driven hundreds of miles through the counties south and west of Corpus Christi, finding four unbanded burrowing owls and occasionally picking up radio collar signals. So far, however, he has not sighted a banded owl from Canada.

In early December, Jason Duxbury, a graduate student researcher, copied an owl tag from an aircraft west of Kingsville, Texas. He also picked up a signal from the air over Tamaulipas, Mexico, but neither owl could be located on the ground. New burrowing owl habitats were discovered by the Saskatchewan researchers in Texas and Mexico during an expedition in February, but none of these owls had Canadian radio tags or leg bands. It is unknown if the newly documented Texas and Mexico owls are permanent residents or if they migrate in and out of these places. Much more research is needed on this threatened species, which is listed as endangered in Canada. Additional studies will be done as funding permits.

Most of the tags for the 1998–99 Saskatchewan study have exceeded their anticipated battery life. There are still eleven owls out there with 8-month-duration tags installed last August and September. They may still be on the air when you get this issue. Frequencies are listed at the "Homing In" Web site, or you can get the list by sending a self-addressed stamped envelope to me. The expected northward migration period is late March through early May, so if you live in the predicted path (from Texas through North Dakota), please monitor regularly, especially at night. You'll find suggestions for radios, antennas, and monitoring techniques at the Web site.

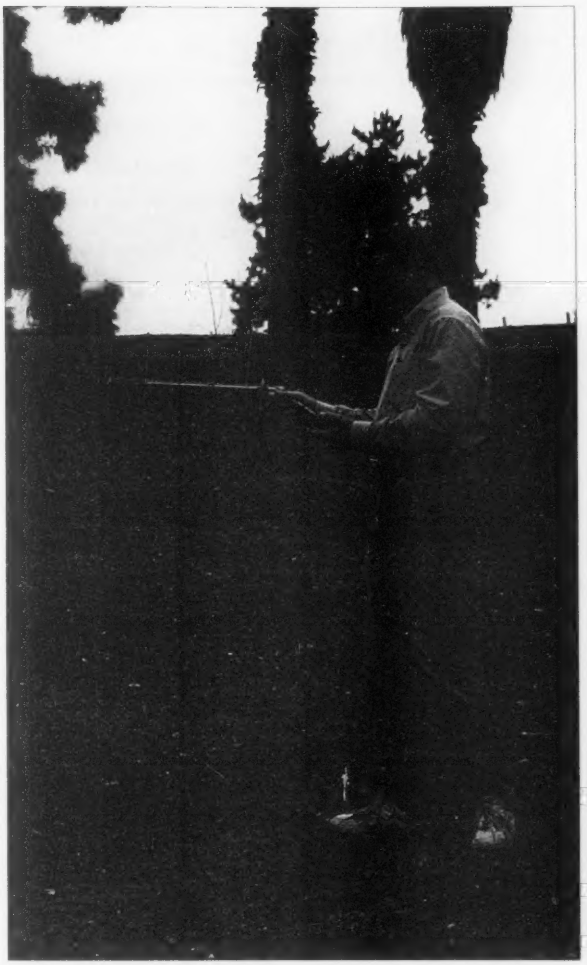

Photo B. *Dave Reeves AC6PP pauses to get a bearing during a 440 MHz all-on-foot foxhunt in a Fullerton park. All that he needs to get good bearings with his handie-talkie is a lightweight yagi with an attenuator mounted on the boom.*

Many hams outside the migration range of the Saskatchewan owls have written to me, asking how they can participate in similar research projects. I am working on several possibilities right now. For instance, a study of brown pelicans by a California university is being planned for the west coast of the USA and Mexico later this year. If funding can be found, researchers will tag additional birds to be tracked by volunteer monitors. The tags will be in the 148 MHz range, making it much easier for hams to use existing two-meter base and portable antennas than it has been with the Burrowing Owl Project.

In addition, the renowned Cornell University Laboratory of Ornithology is considering volunteer monitoring for an upcoming West Coast project. If you would like to participate in these studies or others, please send postal or E-mail to me right away, giving your location and receiving capabilities. You don't need portable RDF gear, but it would help. 73

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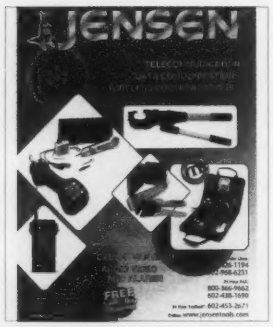

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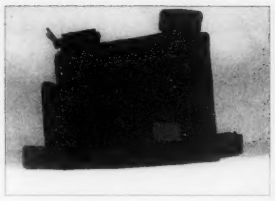
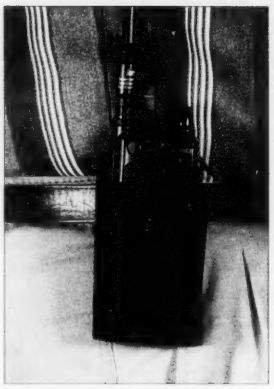


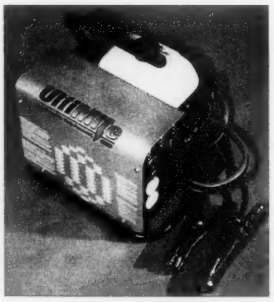


For Ham SWAT Teams

MFJ has come up with a couple of great accessories for emergency operators and on-the-go hams. Their new HamGear™ Tactical Chest Harness is perfect for portable use, DXpeditions, Field Day, biking, and hiking, not to mention search and rescue and other types of missions where hands-free operation can be a plus. MFJ's HamGear™ Belt Radio Holder protects your radio from harm, theft, and misplacement, while holding it vertically (as does the harness) to improve reception. Both of these handy items are made of rugged materials for long life under tough conditions. MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762; (601) 323-5869; FAX (601) 323-6551.

MFJ Duckies

MFJ's new Model 1817 is a dual-band 144/440 MHz HT antenna that successfully blends the telescopic and flexible features found in several different antennas into a single antenna incorporating both popular traits. When retracted, it's 9 inches high and acts like a rubber duck. When extended to 14-1/2 inches, you get a super range extender at maximum radiated power that is hard to beat. Little brother Model 1816 doesn't have the extra gain; it's 6 inches when down and 8-1/2 inches up. Both of these HT duck antennas are extremely rugged, super flexible, and built to last. MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762; (601) 323-5869; FAX (601) 323-6551.



ULTIMITE Generator

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I have been curious for some time about a concept that sounded very good. A great effort was put into a program, RITTY, by K6STI. The novel concept, one with which I see other programmers experimenting, is using the sound card in your computer as the main hardware for modulating and demodulating the RTTY signals.

I have discussed before the ChromaPix SSTV software that also uses the sound card, and had wondered why sound card programs for other digital modes weren't surfacing. The real reason is that it is a lot of work and, as you will see, sometimes not very rewarding.

A bad apple can ruin it for the rest of us

Apparently, I waited too long to give this a try. There is some interesting information on the N1RCT Web site concerning this adventure. It seems that the RITTY program was into its second version and working quite well, but there developed a snag. An unscrupulous hacker got hold of a copy and made a counterfeit version that he was distributing at a reduced price.

The originator of the program has now withdrawn it from the market and has a very sour taste in his mouth from those who would thwart his honest efforts. I guess that is one of the pitfalls of this high tech stuff. It seems the hacker even bragged to K6STI how he had broken through the code.

Lots of good info

The N1RCT Web page is filled with a lot of information about other RTTY projects, with links for more information and downloads as well as programs that do CW, PACTOR, WEFAX and some SSTV thrown in. Very comprehensive, at [http://oxford.megalink.net/~n1rct/index.html].

I happened onto the site as I ran a search for RITTY. It was interesting just for that purpose, and then I realized I wasn't even on the index page. So the above address is the home page from which you will find a wealth of links to much info. You will find some links that are already listed in **Table 1,** and many more of which I was not aware, so a little exploring may turn up something you have been waiting for. There is nothing that says that I have found all the best ham stuff and there is nothing left out there to unearth. Let me know if you find something useful before I get back there to check further.

Bogus E-mail ad?

When I was viewing my E-mail the other day, I found a commercial piece in there that looked fairly legitimate telling me how time was running out to purchase one of the few remaining copies of *The Communicator's Handbook*. It guaranteed that I or someone had entered my name into their database and that I should therefore be interested.

The soon-to-be-unavailable book promised to reveal all there is to know about radio and even give a look at future forms of radio communication that haven't been invented yet. It was only $20 and, again, I had better hurry.

Current Web Addresses

Source for:	Web address (URL)
HF serial modem plans + software	http://www.accessone.com/~tmayhan/index.htm
PCFlexnet communications free programs	http://d10td.afthd.th-darmstadt.de/~flexnet/index.html
Tom Sailer's info on PCFlexnet	http://www.ife.ee.ethz.ch/~sailer/pcf/
SV2AGW free Win95 programs	http://www.forthnet.gr/sv2agw/
BayCom – German site	http://www.baycom.de/
Pasokon SSTV programs & hardware	http://www.ultranet.com/~sstv/lite.html
Winpack shareware for Windows	http://www.duckles.demon.co.uk/ham/wp.htm
Baycom 1.5 and Manual.zip in English	http://www.cs.wvu.edu/~acm/gopher/Software/baycom/
Source for BayPac BP-2M	http://www.tigertronics.com/
Tucson Amateur Packet Radio—where packet started—new modes on the way	http://www.tapr.org
TNC to radio wiring help	http://prairie.lakes.com/~medcalf/ztx/wire/
ChromaPIX & W95SSTV	http://www.siliconpixels.com/
Timewave DSP & former AEA prod	http://www.timewave.com
International Visual Communication Association—a non-profit organization dedicated to SSTV	http://www.mindspring.com/~sstv/
Small computer boards, various kits	http://www.ldgelectronics.com

Table 1. *Current Web addresses. If you encounter a problem with a European address, the network is sometimes at fault. Try again later.*

I assumed one of you readers must have put me on the list to upgrade my radio IQ. I knew I would be an embarrassment to the ham community if I didn't at least check it out, so I did. I dialed up the [amazon.com] Web site and got the info sheet on the "book of all knowledge" hitherto and in the future never to be outdone.

It is probably a decent book for the serious SWLer who is just getting started. It promises a list of foreign broadcast stations and their schedules and a lot of other information that the general listening public is not aware of. Also of interest, the price from [amazon.com] was about half of what the E-mail promoter was going to let me have it for if I got in right away. Plus, the information is a little dated. The book was published at the beginning of 1997.

So, if you have gotten such an offer, those are the things I found. I doubt if anyone really volunteered my name. The E-mail guru probably has a CD of ham addresses. Not hard to come by—just send money.

Also in my mailbag: I got a request for info on how to wire the Kenwood VC-H1 to the ICOM 735. Right up my alley ... kinda. This was just before writing this article, and I had to pose a few questions to the writer concerning whether a plug is available for the Kenwood end and if he could identify the Kenwood pinout.

That is another piece of equipment I have not had an opportunity to hold in my hands. It is a novel setup, in that it is a digital camera that will interface to a Kenwood handheld and, I think, a serial port on your computer. There is quite an advantage to any digital camera for SSTV because you can bypass the developing of roll film, plus, with the VC-H1 at least, you can immediately send the digitized image file directly out over the airwaves.

I am still at the developing and scanning stages. This may change, as I was informed by the info seeker that the prices have dropped somewhat. The original asking price was around $500. Not an outrageous sum of money, but I don't know how versatile the unit is. There are some pretty good units out there for about that price range that lack the direct interface to a radio, of course.

Retrospect

Time is catching up with you when the months seem shorter at a rapidly decreasing pace. It seems not too long ago that Christmas took forever to come from year to year.

This column isn't about aging, or even aging gracefully (I let Wayne expound on those things ... He is one of the few who have been making footprints in the sand longer than I.), but sometimes I get a fix on something that I have to tell you about.

And there is a problem when I get off the track a little as I did with the story of my mobile antenna a short while ago. I received one vocal (via E-mail) reprimand from Marv W5MTV that gave me reason to evaluate the purpose of this column and why I write it.

The purpose is to relay my excitement about the digital modes of ham radio to such an extent that you will want to give one or more of them a try. I haven't tried everything, but those of you who have stuck with me have seen quite a few modes and pieces of software that I have discovered.

I know this because many write and ask for more information or just simply to give a word of thanks and encouragement. That makes it well worth my while (even when the whiles seem to get closer together.)

I answered Marv and apologized for spending so much time with the antenna project. I explained that I had gotten enthusiastic about the project and wished to share the news. Just simply got carried away.

A real learning experience

I am still working on this project. I don't know if I reinvented the wheel, but I learned some things that were never evident within the confines of the stationary shack. My first attempt to run the laptop with the HF radio turned into a small disaster. It was a different set of circumstances than using VHF for packet in the same vehicle.

Some of you probably recall that I am using the Radio Shack® voltage inverter to power the laptop. I found out that that device emits a small signal which got right into the ICOM 735. I found too that some of the interference went away when I disconnected the serial cable, but was still prevalent at regular frequency intervals about everywhere I listened until I turned the inverter off.

As if that wasn't enough problem, I began to notice a new phenomenon as I was driving along attempting SSB. When I would push the PTT, the radio would send a signal of 25 to 75 watts without me uttering a peep into the mike. That wouldn't have been so bad, but during closer observation, I found this didn't happen with the vehicle at standstill with the engine still running!

It was just about hair-pulling time. Something in the vehicle was generating RF, but apparently only when the wheels rotated. Then it changed. After another few hundred miles (I was on a 500-mile trip), the RF was being picked up when we were at a standstill as well as when we were rolling. I never made a contact to see if the signal was readable. It was one of those times when I thought briefly about asking a local ham to monitor, then invested a little time in logic. The problems needed a cure regardless of what the resulting signal distortion was or, perhaps, was not.

As my mind wandered down various avenues, I thought of the few things that might possibly

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Well, just when you thought it was safe to unlock your doors, I'm back! Just a short vacation from the column to get caught up on other projects. With the Y2K bug getting ready to bite in less than eight months, I've been very busy installing utility grid backup systems all over the place. Some of these systems can really make a QRPer drool! Can you imagine having over 33 kW hours of battery storage sitting in your garage waiting for the big one to hit?! Can you just begin to imagine how long you could operate an Argonaut 509 from that battery bank?!

In case you don't know what a grid backup system is, let me take a few minutes to give you a quick overview.

Although it is technically possible to operate everything you may have in your house during a power outage, lack of money usually dictates what will operate. Oh, yes: If your home is all-electric, forget about the electric stove, electric water heater and electric clothes dryer. It can be done, but the expense outweighs common sense.

So, you select what loads you want to operate on the backup system. This may be your computer room, ham shack, family room and so on. You can usually load up to 60 amps of AC loads. You then pull these out of the main circuit breaker and install a subpanel.

A DC-to-AC inverter is installed in the house. I use the Trace SW series inverters. These guys produce up to 5.5 kW and you can gang two inverters together for a total of 11 kW worth of backup power. The output of the SW series is pure sine wave. Not the modified sine wave you see in some inverters. The output is so clean, you can sell the power generated by the inverter *back* to the utility. That's a lot of bang, and it takes a lot of batteries to do the job.

In most systems we do, I use the Trojan L16 deep-cycle battery. At over 350 amp-hours each, these guys are big and heavy.

So, how does the system work? Well it's all automatic and completely transparent to the user. When you have grid power, the inverter sits there charging up the batteries. The charger will float the system all

---

generate a signal in the RV conversion. There is an igniter in the propane refrigerator. Turning that off made no difference. About the only other possibilities of generating RF were the ignition system, wheel bearings (or more likely brakes) or the cruise control. These ideas came along before the problem showed itself with the vehicle parked.

Logic ... The radio had performed very well under test conditions when transmission line and 12 volt supply were strewn across the floor in a haphazard array. Once neatness took over, the problems began. Simply, to make this as short as possible, I had coiled the excess 12 volt feed, taped it neatly and stood it vertically behind the driver's seat. It had become an antenna.

After other items in the same storage space had been removed and replaced several times, the loop went horizontal and the character of the problem changed. More logic ... I didn't care what the source of the mysterious RF was or is. It was only necessary to eliminate its effect.

The cure was to wrap several turns of the RF feed through a toroid, making an RF choke—and what a difference. The PTT transmit problem disappeared as well as the interference from the Radio Shack inverter.

I pass these items along because they may be of value if you should experience such problems with a mobile installation—especially readers of this column, who would include a computer. I haven't placed the radio in its permanent location yet. Perhaps when the 12 volt line is cut to length and the loop is removed it will not be such an effective antenna. Nevertheless, it will be some kind of antenna that may still need to be dealt with and so far the toroid works for me.

I mentioned previously that I was getting one of the automatic antenna tuners from LDG Electronics. I did. It is a beautiful piece of equipment. If I weren't so bent on assembling things myself, I would be using it by now. For an extra $40 they will assemble it and that is well worth the price. So, as time constraints go, it will be a while yet.

Final demise of the packet modem kit

One point of interest here is that Dwaine at LDG confirms the fact that there are no more chips to make the packet modem kit he was selling. About a year ago he had a little over 100 of those kits left. He said that they suddenly disappeared when he made notice on his Web site that they were the last of the breed. I would like to flatter myself into thinking that you readers led the rush to buy those after I wrote the article on the modem at about that time. However, I know of only one reader who actually purchased a modem kit, so it was more likely Dwaine's clever "they're going fast" marketing approach. Anyway, all good things come to an end.

There are new things out there

It would be nice if I could get my hands on everything that is used in the digital modes. Some are only available by outright purchase. I have some of those, along with numerous freebies or trial-before-purchase items.

I am going to have to speak to some of the providers who would like a little exposure in this column. To be honest, I have never had my hands on any of the pieces of standard fare from Kantronics™. Not their fault—I just need to be more aggressive.

My ideas of standard fare currently revolve around the AEA PK-232MBX, which is getting pretty ancient; the packet TNC-2 clone from MFJ; their model 1274; the Timewave DSP-599zx with its custom DSP-RTTY software package; and the numerous software programs I have discussed in this column such as XPWare, which works exceptionally well with my PK-232MBX; HamComm, which is shareware that does a pretty fair job with my laptop; ChromaPix, which uses the SB16 sound card in my desktop for SSTV; and Pasokon, which performs wonders in my laptop with a homebrew serial modem for SSTV—to name a few. And I must not neglect to mention the BayCom-style packet modems and various software packages. You can find more info on most of this at the Web sites in **Table 1**.

If you have questions or comments about this column, please E-mail me at [jheller@sierra.net] and/or CompuServe [72130,1352].

I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO. 73

the time, or you can tell it only to charge the battery bank at a certain time of the day. This is used mainly to reduce the cost of operating the charger.

All the AC loads, including the ones in the subpanel, are being powered by the grid. The inverter is sitting there running in parallel with the grid. Its output is in sync with the grid, matching it with the proper phase and voltage. If the grid goes down, the inverter that is running along with the grid tries to operate the entire electrical grid. It can't, so in about 30 milliseconds the inverter drops out and comes back up. With the inverter now up, it powers only the loads that have been selected in the subpanel.

The run time of the inverter depends on many factors. The biggest one is the size of the loads you'll be running. The second factor is the capacity of the battery bank you're using. Since a normal inverter is rated at 4 kW, if you would load the inverter down to its maximum capacity with a 750 amp-hour battery, the battery would be dead in about five hours. Lighter loads, and the battery bank will run longer. In most cases, you can plan on getting from one to four days of inverter power.

When the grid comes back on, the inverter once again becomes a charger and the battery bank is quickly recharged. The system then waits until the next outage.

Got a generator? No problem! The inverter has the smarts to ask the generator to start up (assuming the generator has an electric starter!) and recharge the batteries if they get too low.

So that's what a grid backup Y2K system is. Of course, you don't need to wait until the year 2000 for a system like this. A good old-fashioned thunderstorm can knock out your power just as quickly as any computer bug.

Oh, yeah—the bottom line. Most systems run about $4000 to $9000, depending on the type of inverter, battery and options such as solar panels.

That's what I've been up to, and later on in the year, as we get closer to December 31, 1999, I'll really get busy! But, let's relax and get ready for the Dayton Hamvention. Once again, the QRP ARCI will be hosting FDIM at the Days Inn. Here's the poop, from the chairperson himself:

QRP Amateur Radio Club, International (QRP-ARCI), proudly announces the fourth annual "Four Days In May" QRP Conference commencing Thursday, May 13, 1999—the first of four festive days of 1999 Dayton Hamvention activities. Mark your calendar for this extra bonus day and register early for this not-to-be-missed QRP event of 1999.

Amateur Radio QRP presentations, workshops and demonstrations will be the focus of the full day Thursday QRP Symposium to be held at QRP ARCI headquarters—the Days Inn Dayton South. Last year, this sold-out event had a "standing room only" crowd of 175 enthusiastic attendees. FDIM QRP Symposium attendees will start their day with a wake-up coffee social and then plunge into a full day of multimedia QRP presentations by renowned QRP authors and designers.

Papers to be presented include:

- *Vertical Antenna Design & Analysis,* by L.B. Cebik W4RNL
- *Constructing QRP Equipment,* by Rev. George Dobbs G3RJV
- *Design of a DSP-based Coherent CW Xcvr,* by George Heron N2APB
- *QRP Construction Tools & Tricks,* by Dick Pascoe GØBPS
- *Mixer Madness,* by Clark Fishman WA2UNN
- *PIC-based Rainbow SWR Bridge/Tuner,* by Joe Everhart N2CX
- *When Signals Go Wrong—Distortion Demystified,* by Dave Benson NN1G

Culminating this first day will be an evening QRP ARCI Author Social for folks to meet the QRP presenters. All are invited.

The QRP ARCI "Four Days In May" 99 QRP Symposium will be the talk of the Dayton Hamvention.

The "Four Days In May" QRP extravaganza continues with the annual Friday night QRP ARCI Awards Banquet honoring QRP dignitaries for their service to the amateur radio community. A special evening has been set aside after the banquet for the FDIM QRP Vendor Social, where prizes will be drawn. All are invited.

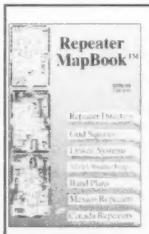
FDIM Saturday will be special this year, with an evening social for QRPers to meet the many regional North American and International QRP Club members—bring your banners! The evening culminates with a *building contest* ... the categories are wide open, so bring your latest kit, home-brew project, antennas, whatever! Judges will select winners for prizes, for a feature article spot in the next *QRP Quarterly,* and for possible project kitting, courtesy of the QRP ARCI. All are invited.

QRP Symposium presenters

Please submit your QRP technical manuscripts to FDIM 99 Technical Paper Chairperson George Heron N2APB, 45 Fieldstone Trail, Sparta NJ 07871, [n2apb@amsat.org]. FDIM 99 QRP Symposium Proceedings will be available for sale during and after the Conference for those unable to attend the Symposium.

FDIM QRP Symposium registration

Registration for the Thursday, May 13, 1999 FDIM QRP Symposium will be $10 if prepaid by May 1, 1999, and $12 after that date, or at the door. "At the



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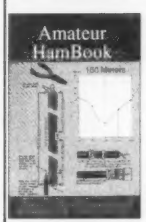

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SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the August issue, we should receive it by May 31. Provide a clear, concise summary of the essential details about your Special Event.

MAY 1

CADILLAC, MI The Wexaukee ARC will hold their annual Amateur Radio and Computer Swap Meet 8 a.m.–1 p.m. at the Cadillac Middle School. VE exams for all classes at 1 p.m. Admission $5; 8-ft. table $6. Setup at 6 a.m., table holders only. Talk-in on 146.98 rptr. Contact *Dan KE8KU, Wexaukee ARC, P.O. Box 163, Cadillac MI 49601. Tel. (616) 775-0998; E-mail [ke8kudan@juno.com].*

CEDARBURG, WI The 21st Annual Cedarburg Swapfest will be held 8 a.m.–1 p.m. at the Circle-B Recreation Center, Hwy. 60 and County I (located 20 miles north of Milwaukee, west of Grafton). Admission is $4 in advance and $4 at the door. 4-ft. tables are $5 (limited power available on request). Sellers' setup at 6:30 a.m. VE exams start at 9 a.m. For admission tickets, table reservations, maps, or more info, send an SASE to *Joe Holly, ORC Swapfest Chairman, 1702 Holly Lane, Grafton WI 53024. Tel. (414) 377-2137;* or *Skip Douglas at (414) 284-3271.* This event is being sponsored by the Ozaukee Radio Club of Mequon WI.

MONUMENT, CO The Pikes Peak Radio Amateur Assn. Gigantic Hamfest will be held on May 1st, 0800–1400, at Lewis-Palmer High School, 1300 E. Higby Rd., I-25 between exit 158 and 161. Free parking. Admission is $4 for 18 and over. VE exams at 1000, forums, APRS, packet, satellite demos. Vendor setup Fri. eve. at 1800, Sat. morning at 0600. Tables $12, $10 ea. additional. Talk-in on 146.97 (100 Hz) and 146.52. For tables, contact *Dennis NØABC, (719) 535-1160, [dennis.major@mci.com]; or Bob KIØGF, (719) 265-9950, [rryals@pcisys.net].* Write to *PPRAA, P.O. Box 16521, Colorado Springs CO 80935.* Check the Web site at *[http://www.qsl.net/ppraa/].*

ST. LOUIS, MO All-day Skywarn Weather Observation Training will be offered Sat., May 1st. Level 1 Training will be presented in the morning, and classes resume in the afternoon with the SKYWARN Level 2 Program. For locations, call the *Severe Weather Information Line, (314) 889-2857* for a taped message and additional information. All are welcome. Free parking. Certification provided for R.A.C.E.S. and SKYWARN at no cost.

MAY 1–2

ABILENE, TX The Key City ARC will sponsor the West Texas Section Convention and Hamfest at the Abilene Civic Center, Sat., May 1st, 8 a.m.–5 p.m., and Sun., May 2nd, 9 a.m.–2 p.m. Free parking. VE exams. Wheelchair access. Limited RV parking for a nominal fee. Tables $6. Pre-registration for the prize drawing is $7 (must be received by April 27th), $8 at the door. Talk-in on 146.160/.760. For reservations and info, contact *Peg Richard, 1442 Lakeside Dr., Abilene TX 79602. Tel. (915) 672-8889.*

MAY 2

YONKERS, NY The Metro 70cm Network will present another Giant Electronic Flea Market at Lincoln High School, Kneeland Ave., Yonkers NY, 9 a.m.–3 p.m., rain or shine. Free parking. No tailgating. Indoor flea market only. Pre-registered tables, vendors $19 first table, $15 each additional table. All tables 30-ft. x 5-ft., or bring your own tables at $14 for a 6-ft. space. Full payment is due with registration. At the door, each table is $25, or $20 for a 6-ft. space. Mail paid reservations to *Metro 70 CM Network, 53 Hayward St., Yonkers NY 10704.* No paid reservations for space will be held past 9 a.m. No refunds given unless prior notification of cancellation has been received 72 hours in advance of this event. Table setups 7 a.m. For registration, call *Otto Supliski WB2SLQ,*

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door" registration may be limited if, once again, we sell out. Please register early to guarantee a seat. Registration will cover a full day of QRP Symposium activities, including the QRP technical presentations and an endless QRO coffee pot. The $10 registration fee also includes a complimentary copy of the FDIM 98 QRP Symposium Proceedings.

Please send your $10 registration fee (US check, money order, international money order) made out to "QRP ARCI" and an SASE by May 1, 1999, to: Philip Specht, 925 Saddle Ridge, Roswell GA 30076 USA, or E-mail [k4pqc@bellsouth.net] for information. Along with your registration check, please provide the name, US mail address, telephone number and E-mail address of each attendee. Also provide callsign(s) if available and a self-addressed stamped envelope if return confirmation is desired.

Awards Banquet registration

This not-to-be-missed Friday, May 14, 1999, event is being hosted by FDIM Banquet Chairperson Scott Rosenfeld NF3I. Please send your $25 banquet ticket fee (US check, money order, international money order) made out to "QRP ARCI" and an SASE by May 1, 1999, to: Scott Rosenfeld NF3I, QRP ARCI Banquet Tickets, 2250 Paterson St. 50, Eugene OR 97405-2988 USA. Along with your registration check, please provide the name, US mail address, telephone number and E-mail address of each attendee. Also provide callsign(s) if available and a self-addressed stamped envelope if return confirmation is desired.

FDIM QRP Vendor Social

A tradition was started several years ago—a special evening was set aside to officially introduce our QRP vendors from around the world. This year, all are invited to attend this wonderful gathering of vendors during each of the three evenings' socials. Jim Stafford W4QO, QRP ARCI vice president, will be the host this year. QRP vendors—for registration information, please contact Jim Stafford W4QO, QRP Vendor Evening Chairperson, at 11395 West Road, Roswell GA 30075, or via E-mail: [w4qo@amsat.org].

QRP ARCI FDIM headquarters

The Days Inn Dayton South (DIDS) will be the 1999 FDIM QRP headquarters. Hank Kohl K8DD has arranged a special block of reduced-rate rooms to be held at the hotel for FDIM attendees wishing to conveniently stay at the ARCI headquarters for the weekend festivities. Rooms are $72/night (+ tax) with as many occupants as desired. Let Hank know if you will be needing one of these special rate rooms. He can be reached at: QRP-ARCI Rooms, 1640 Henry, Port Huron MI 48060-2523 USA. You can also contact Hank by E-mail at: [k8dd@ contesting.com].

On behalf of the QRP ARCI team, we invite you all to join us for the QRP Event of 1999—the "Four Days In May" 99 QRP Conference at the 1999 Dayton Hamvention. See you all there! 73/72, *Ken Evans W4DU, FDIM 99 Chairperson. E-mail: [w4du@bellsouth.net].* 73

(914) 969-1053. Donation $6, kids under 12 free. Talk-in on 440.425 MHz, PL 156.7; 223.760 MHz PL 67.0; 146.910 MHz; and 443.350 MHz PL 156.7.

MAY 8

MANITOWOC, WI The Mancorad Radio Club will hold their 1999 Hamfest and Computer Swapfest at the Manitowoc County Expo Center, intersection of Hwys. 42-151 and I-43 on Co. R, 8 a.m.–noon. Features include an amateur/computer/electronic flea market, and VE exams. Admission is $3 in advance or $4 at the door. Dealer setup Fri. 6 p.m.–9 p.m., or Sat. at 6 a.m. 8-ft. tables $6, electric outlet $5. SASE to *Mancorad RC, P.O. Box 204, Manitowoc WI 54221-0204;* or call *Red (920) 684-3733;* or *Fred at (920) 682-9312.* For camping arrangements, call *(920) 683-4378.*

MAY 15

GRIMESLAND, NC The East Carolina Antique Radio Club Swap Meet, "ECARC Radiofeast 1999," will be held 8 a.m.–3 p.m. in the East Carolina Radio Museum parking lot at 7602 Pitt St. in Grimesland. Hwy. 33, 10 miles east of Greenville NC. Free admission. Tailgate space $7. Contact *Bill Engstrom, 218 Bent Creek Rd., Greenville NC 27834, (252) 355-8732; or Herman Schnur K4CTG, 3205 Brick Kiln Rd., Greenville NC 27858, (252) 752-2264.*

MAY 22

LONDONDERRY, NH The Interstate Repeater Society will hold an Amateur Radio Swap Meet on Sat., May 22nd, at the Londonderry Lions Club on Mammoth Road. Dealer setup starts at 6 a.m., and general admission ($2) at 8 a.m. Dealer spaces are $10. Inside and outside spaces available. Directions: Rt. 93 to Exit 4, west on Rt. 102 about 2 miles to Mammoth Rd. (Rt. 128). Go north about 1-1/2 miles to the hall on the right. For reservations call *Paul K1LL, (603) 432-1538; or E-mail to [K1LLX@juno.com].*

MAY 23

FAIR OAKS, CA The North Hills Radio Club of Sacramento CA will hold its annual Swapmeet, 6 a.m.–12 p.m., at the Bella Vista High School, 8301 Madison Ave., Fair Oaks CA. From I-80, take Madison Ave. east for 5.8 miles to the high school. From Hwy. 50, take Hazel Ave. north 2.6 miles to Madison Ave., turn left and go west 1.4 miles to the high school. Seller spaces $10 (two parking spaces), buyers admitted free. New, used, and surplus amateur radio gear, electronic test equip., and amateur-related computer gear. Contact *Earl Mead K6ESM, (916) 331-1115; or E-mail [nhrc@k6is.org].*

MAY 30

WEST FRIENDSHIP, MD The Maryland FM Assn. of Hanover MD will hold the MFMA Hamfest on May 30th, 8 a.m.–2:30 p.m. at Howard Co. Fairgrounds. Take 170 to Rte. 32, south to Rte. 144, turn right, go west on Rte. 144, approx. 1 mi. to the Fairgrounds. Talk-in on 146.76, 224.76, or 444.00. Admission $5, tables in advance $20, $25 at the door. Tailgate spaces $5 ea. For reservations, contact *Craig WA3TID, P.O. Box 19, Annapolis Junction MD 20701. Tel. (410) 987-6042.*

JUNE 5

BANGOR, ME The 12th Annual Bangor Hamfest will be sponsored by the Pine State ARC, 08:00–13:00, at Hermon High School. Take I-95 to Exit 44 (Cold Brook Rd.) to US #2; US #2 west 1 mile to the high school. From the village, take US #2 east 1/2 mile to the school. Talk-in on 146.34/.94 and 146.52. VE exams will be held for all classes. Features: Vintage equipment, a fox hunt, FSTV, VHF, packet, antenna feeds. Set up a ham shack to help newcomers. Admission $4 per person, under 12 years free. Tables $8 each. Equipment will be auctioned at the end of the hamfest. There are campgrounds and many motels within 5 miles. This event will be held rain or shine. Contact *Robert W. Dole KA1TKS, RR #2 Box 730, Bangor ME 04401. Tel. (207) 848-3846.*

GRAND RAPIDS, MI The annually sponsored IRA Hamfestival, west Michigan's largest hamfest, will be held June 5th at the Hudsonville Fairgrounds near Grand Rapids. Doors open at 8 a.m. for general admission. Dealers can setup on the 4th after 7 p.m., or after 6 a.m. on the 5th. Overnight camping is available. This year's swap will host 5 technical seminars, the Michigan Area Repeater Council June quarterly meeting, and the State and District 6 Emergency Co-ordinators will provide a forum entitled "Y2K and Amateur Radio." VE exams at 12 noon. Talk-in on 147.16 link repeater system. Indoor table space and trunk sales spaces are available. Contact *Kathy at (616) 698-6627 between 4 p.m. and 7 p.m. EST.*

HOUSTON, MO The 1st Annual Central Ozarks Hamfest will be held by the Ozark Mountain Repeater Group, 8 a.m.–3 p.m. at Texas County Fairgrounds, 1.5 miles north of Houston MO, on Highway 63. Setup at 6 a.m. Trade tables $10, or outside space $5. Commercial tables $15. Talk-in on 146.850. Contact *Bob Simpson NØNTC, 9570 Haney Drive, Houston MO 65483. Tel. (417) 967-3535, or E-mail [nOntc@train.missouri.org].*

SPRINGFIELD, IL The Sagamon Valley Radio Club will join with the Shooting Stars 4-H Club to present a Hamfest at Illinois State Fairgrounds in Springfield. Free parking. ARRL VE exams. Indoor exhibits. Talk-in on 146.685(-). Admission $5. Visit the web site at [www.skylight1.com/svrc/]. Contact *Ed Gaffney KA9ETP, 13997 Frazee Rd. Box 14A, Divernon IL 62530. Tel. (217) 628-3697, or E-mail [egaffney@fgi.net].*

TEANECK, NJ The Bergen ARA will hold its annual Spring Hamfest at Fairleigh Dickinson University. Take Rte 4 east/west to the River Road exit. Follow the signs into the hamfest area. Buyer admission $5, with XYLs and harmonics free. Seller admission $10. Plenty of parking. VE exams. Talk-in on 146.790(-600). For more info call *Jim Joyce K2ZO at (201) 664-6725 before 10 p.m.*

JUNE 6

BUTLER, PA The 45th Breezeshooters' Hamfest will be held Sun. June 6th, 8 a.m.–4 p.m. on the Butler Farm Show grounds, just north of Butler. Admission is $5 per person, includes prize drawings during the hamfest; children under 12 admitted free. To reach the hamfest, take PA Rt. 68 East from Interstate 79, or take US Rt. 68 West from PA Rt. 8. Talk-in on 147.96/.36. Facilities are handicapped accessible. Tailgate spaces $5 each. Dealers can rent tables in advance at $15 per table. Reservation deadline is May 15th. To reserve a table, send check for $15 per table and an SASE to *Rey Whanger W3BIS, Hamfest Chairman, 5430 Cove Run Road, Cheswick PA 15024; or call (412) 828-9383.* E-mail can be sent to *[w3bis@freewwweb.com].* The Web site is at *[www.breezeshooters.com].*

MANASSAS, VA The Manassas Hamfest, Amateur Radio, Electronics & Computer Show is being presented by Ole Virginia Hams ARC, Inc., Sun. June 6th at Prince William County Fairgrounds (1/2 mile south of Manassas VA on Rte 234). Talk-in on 146.97(-) and 224.660(-). Indoor exhibitor space has 8-ft. tables and electricity. Setup 2 p.m.–8 p.m. Sat. General admission $5 per person at the gate. No advance sale. Gates open at 8 a.m. Free parking. Tailgate spaces $5 (plus admission), gates open at 7 a.m. ARRL Roanoke Div. officers will be attending. DXCC QSL Card Checkers will be available. There will also be a "Virginia QSO Party" Award Ceremony. You can find hamfest details on the Web at *[http://www.qsl.net/olevahams].* For dealer info contact *Jack N4YIC, (703) 335-9139; E-mail [patnjack@erols.com].* For general info, contact *Mary Lu KB4EFP, (703) 369-2877; E-mail [mblasd1638@aol.com].*

MEDINA, OH Join the M2M Group for the 1999 Medina County Hamfest, Sun., June 6th, at the Medina County Fairgrounds Community Center, 735 Lafayette Road, in Medina. Vendor setup at 6:30 a.m. Open to the public 8 a.m.–3 p.m. New and used ham gear and computer equipment will be featured. Talk-in on 147.630/.030. General admission $4 in advance, $5 at the door. Inside tables $9 in advance, $10 at the door. Flea market spaces $7 in advance, $8 at the door. Please call Doug at (330) 725-0119 for info about VE exams; walk-ins welcome. For tickets and general info, contact *Mike at (330) 273-1519, or E-mail [m2mgroup@*

aol.com]. Vendors please note: No tables will be reserved without payment. Prepaid tables will be held until 9 a.m. Send payments with an SASE to the *Medina Hamfest Committee, P.O. Box 452, Medina OH 44258,* before May 22nd.

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Corona Park, 47-01 111th St., Queens. Doors open for vendor setup at 7:30 a.m. Buyers admitted at 9 a.m. Free parking. Admission by donation, buyers $5, sellers $10 per space. Talk-in on 444.200 rptr., PL 136.5, 146.52 simplex. For further info call evenings, *Stephen Greenbaum WB2KDG, (718) 898-5599; or E-mail [WB2KDG@Bigfoot.com].*

JUNE 12

FERGUS, ONTARIO, CANADA The Guelph ARC and Kitchener-Waterloo ARC, Inc. are getting together to jointly sponsor The Central Ontario Amateur Radio Fleamarket. The event will be held 8 a.m. to 2 p.m. at the Fergus Community Center. Vendors admitted from 6 a.m. Talk-in on 146.97(-) or 145.21(-). Contact *Bill Smith VE3WHS, 32 McElderry Rd., Guelph ON, Canada N1G 4K6. Tel. (519) 821-6642. Packet [VE3WHS@VA3SED.#SWON.ON.CA.NA]. E-mail: [smith.ve3whs@sympatico.ca].*

JUNE 13

INDEPENDENCE, KY The Northern Kentucky ARC will hold their "Ham-O-Rama '99'" on Sun., June 13th at the Summit View Middle School in Independence KY. From I-75 go east on I-275 to Exit 80 (Covington/Independence–KY 17). South on KY 17 (towards Independence) 5-1/4 miles. For more info or reservations, contact *N8JMV c/o NKARC, P.O. Box 1062, Covington KY 41012; or call (513) 797-7252 in the evening.* Indoor exhibit area for major vendors. Extensive outside flea market with setup at 6 a.m. General admission begins at 8 a.m. Admission $4 in advance, $5 at the gate. Children under 14 admitted free. Flea market spaces $2 each (tables not furnished). Indoor vendor space $15 per table provided. Talk-in on 147.255(+) and 147.375(+) rptrs.

KNOXVILLE, TN The Radio Amateur Club of Knoxville is sponsoring the 33rd annual "Knoxville Hamfest and Electronics Flea Market" on June 13th at the National Guard Armory, 3330 Sutherland Ave., in Knoxville. Open to the public 9 a.m.–4 p.m. Admission $5. 8-ft. tables will be supplied for $15 each. AC power also available. Free dealer passes will be provided for all designated workers. Free beverages available for all inside dealers. Access for dealers and other indoor participants starts Sat., June 12th, 12 noon–8 p.m. ET. Access also available on the day of the hamfest, starting at 6 a.m. ET. Free parking and handicap access. Free outdoor tailgate space with each paid admission. VE exams begin at 2 p.m., registration must be completed before 1:30 p.m. Test fee is $6.45, payable to WCARS/VEC, exact cash or check, please. There will be a clinic showing how to use new technology ham radio equipment. A free product literature and product promotional items area will also be featured. Forums are being planned to discuss ham radio in the next century, public service activities, computer architecture, new FCC regulations, DX, etc. Exhibits will feature new technology equipment, satellite communications and emergency communication equipment. Talk-in on W4BBB 147.30(+), 224.50(-), 444.575(+). For general info and reservations, contact *David Bower K4PZT, P.O. Box 50514, Knoxville TN 37950-0514. Tel. (423) 974-5064 (w) or (423) 670-1503 (h). E-mail [rack@korrnet.org].* For updated info check the Web page at *[http://www.korrnet.org/rack].*

SUFFIELD, OH The 32nd Annual Hamfest and Family Picnic will be sponsored 8 a.m.–4 p.m. by the Goodyear ARC at the Goodyear Wingfoot Lake Park, located near Suffield OH, 10 miles east of Akron. Enter from Rt. 43, one mile south of Rt. 224. Admission $4 in advance or $5 at the door. One ticket admits ham, spouse and children. Flea market spaces $10 each or $8 in advance. Vendors (Pavilion) $8 in advance or $10 the day of the hamfest. Make checks payable to the Goodyear ARC and mail with an SASE to *David R. White, 719 Notre Dame, Cuyahoga Falls OH 44221.* VE exams available. For more info call *Dave White at (330) 928-7625 or E-mail [rjtaylor@akron.infi.net].* Talk-in on 146.985/.520. Park rules: No pets, no firearms, no pornographic materials.

WHEATON, IL The Six Meter Club of Chicago, Inc., will hold its 42nd Annual ARRL sponsored Hamfest at the DuPage County Fairgrounds, 2015 Manchester Road [north of Roosevelt Road (Route. 38), east of County Farm Road], in Wheaton. Free parking. No extra charge for space in the outdoor flea market. Tickets are $5 in advance, for attendees over age 12, $6 at the gate. Advance tickets are available from *Joseph Gutwein WA9RIJ, 7109 Blackburn Ave., Downers Grove IL 60516,* or from any club member. Commercial tables, 8-ft. w/110V $15 each. Indoor flea market tables, 8-ft., no electric, $12 each. Overnight RV parking, includes electrical hookup, $10 each. Send an SASE with check or m.o. payable to *Six Meter Club of Chicago,* and mail to *7109 Blackburn Ave., Downers Grove IL 60516,* no later than May 30th. For information call the 24-hour InfoLine, *(708) 442-4961.* Buildings are open to the public at 8 a.m. VE exams 9 a.m.–11 a.m., call the InfoLine to pre-register for testing. Handicap parking at the east gate. General parking at the west gate. Sellers, use east gate. Absolutely no alcoholic beverages permitted. All sellers responsible for cleanup of their spaces.

JUNE 18, 19, 20

RED DEER, ALBERTA, CANADA The Central Alberta Radio League (C.A.R.L.) will host its 29th Annual Picnic and Hamfest at the Burbank Campsite located approximately 8 km NE of Red Deer. Talk-in on 147.150 (+600) or 146.520 simplex. For info contact *Bob VE6BLD, 5540 54th Ave., Lacombe, Alberta, Canada T4L 1L6. Tel. (403) 782-3438 evenings. E-mail [kingel@telusplanet.net] or [ve6bld@rac.ca].* Or E-mail *C.A.R.L. at [carl@qsl.net].* Visit the home page at *[http://qsl.net/carl/]. Bill VE6WMG, at (403) 749-2063,* is also available to relay more info about this event.

SPECIAL EVENT STATIONS

APR 30–MAY 2

AQUINAH, MA The Fall River ARC will work stations for the Massachusetts QSO Party by operating W1ACT/P from the Gay Head lighthouse on Martha's Vineyard island (IOTA NA046) 1600 UTC April 30th–2100 UTC May 2nd. Tune in on 3.755 MHz, 14.260 MHz, 21.260 MHz, and 28.460 MHz. QSL with an SASE to *Roland Daignault N1JOY. E-mail [roland-d@ici.net].*

MAY 8–9

INDIANA QSO PARTY The Land of Lakes ARC will host the Indiana QSO Party, 1800Z May 8th–2300Z May 9th. Categories: Single operator, multi-operator, club station and VHF/UHF. All stations may be worked once per mode on each band by CW and phone. Mobiles may be worked once per mode per Indiana county that they operate from. No repeater contacts. Exchange: Indiana stations—signal report and county; non-Indiana stations—send signal report, state, province, or county. Phone contacts count 2 QSO points, all other modes count 3 QSO points. Suggested freqs.: CW—1810, 3539, 3715, 7045, 7115, 14045, 21045, 21120, 28045, 28120. Phone—1860, 3890, 7280, 14285, 21385, 28400, 50.14, 144.215, 432.120. Certificates will be awarded for first and second place in each category, state, province and country. Send logs with an SASE to *Sharon Brown, 905 W. Parkway Dr., Pleasant Lake IN 46779.* You may also submit logs via E-mail to *[sharon.l.brown@gte.net].* Logs must be received by June 11th, 1999.

JUNE 12, 13

PORTUGAL DAY DX CONTEST The Rede dos Emissores Portugueses will sponsor the Portugal Day DX Contest on phone (SSB) only, on 10 15, 20, 40 and 80 meters, using the recommended IARU band plan for Region 1. For more information, contact *REP—Rede dos Emissores Portugueses, Award/Contest Manager, P.O. Box 2483, 1112 Lisboa Codex, Portugal.* 73

via *World Radio*, via *The Independent Bohemian* (FL), KD4VBI, editor, [kd4vbi@juno.com].

Jerry Skywalker

Amateur radio operators have been erecting antennas since the earliest days of radio. So, perhaps it is apropos that it would be an amateur radio operator—putting up another set of antennas—who would help to write a new chapter in space communications.

The ham radio operator is Jerry Ross N5SCW. He was part of the all-ham crew that flew mission STS-37 in the early 1990s. And now, Jerry was one of two astronauts who ventured out on a spacewalk on Wednesday, December 9th, to attach the antennas to the first United States section of the international space station. The module is called *Unity*.

This was the second of three excursions outside the shuttle *Endeavour* for Ross and James Newman in less than a week. They completed installing two 100-pound antennas on *Unity* at about the three-and-one-half-hours point of a planned seven-hour spacewalk. They then successfully pried open a stuck antenna on the Russian-built *Zarya* space station module.

Even with the antenna repair, the spacewalk was not nearly as difficult as the one on Monday, December 7th. During that excursion, Ross and Newman hooked up forty electrical connections between *Zarya* and *Unity*. This essentially tied the two together as the first stages of the ISS.

But the antennas that Ross and Newman installed outside of the *Unity* module may be just as important. They are part of an elaborate communications system between *Unity* and NASA's Mission Control. Once activated, the system will provide a direct, virtually uninterrupted communications link between the two without having to rely on Russian ground stations for relay.

Rounding out the mission, Ross and Newman also took a third spacewalk and checked out the new space station. And typical of ham radio operation, they kicked those stuck antennas—freeing them for future work when Russian spacecraft come in to dock.

All of this totaled seven spacewalks for N5SCW during his 18-year career as an astronaut. That's the most spacewalks by any American.

Tnx and a flip of the helmet visor to *Newsline*, Bill Pasternak WA6ITF, editor.

War of the Worlds

Call it life imitating art last year. When a Portuguese radio station decided to repeat Orson Welles' famous *War of the Worlds* broadcast, the results were predictable. Graham Kemp VK4BB of *Q-News* reported on the Martians taking on Lisbon:

... On Friday, October 30th, radio station Antena 3, in Lisbon, celebrated the 60th anniversary of the Orson Welles radio drama *War of the Worlds* by rebroadcasting it during the morning show.

The original Welles script was used and translated into Portuguese. The station issued a warning at 7 a.m., announcing their intention to broadcast the radio play. But when the play began an hour later at 8 a.m., panic erupted.

The station broadcast the landing of a UFO at Palmela, and the bulletins said that the Martians had set off in the direction of the capital (Lisbon) and that military forces sent to stop them had proved powerless.

The program's producer said the radio station was inundated with calls from hundreds of panicking people demanding to know what was going on.

The 7 a.m. warning proved worthless because not everyone is listening to the radio that early. Some callers said they had fled their workplaces. Others with health problems complained that their health had deteriorated on news of the Martian invasion.

One of the organizers of the broadcast said, "One hundred years after the invention of the radio, there are still people who will believe anything." ...

All this goes to prove that even sixty years later, some people in radio just never seem to learn.

Tnx and a "run for your life!" to *Q-News*, courtesy of *Newsline*, Bill Pasternak WA6ITF, editor. 73

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grow up and be workers? Ditto your grandkids? All, essentially, members of a giant ant colony or beehive?

Well, golly, we have to work for a living, don't we? Sure, but we don't have to work for someone else all our lives. If you have your own company, you can work for yourself. It's bad enough that, by the time you count up all the taxes, you're working almost half of your life for the government — so Congress and your state legislature can have a ball spending our money.

But, if you have your own company, you set your hours — you set your pay — you set your vacations. And if you make your company one that does business worldwide, you can travel anywhere you want, too. *73* magazine has subscribers in over 200 countries, so anywhere I go I have friends and a group anxious to show me around and listen to me talk.

A few weeks ago Sherry and I took off a few days and visited Iceland. The hams there couldn't have been more friendly. But it's that way everywhere I've been.

When I was interested in Italian greyhounds I naturally started a small magazine on the subject, and that led me to visit Italian greyhound lovers all around the US, in England, Sweden, and several other countries. It was the same when I started publishing computer magazines — they even paid my way to South Africa to address a computer conference there! And I gave talks on computers in many other countries on all continents.

My book, the *Secret Guide to Wealth,* explains how you can get other people to pay you to learn what you need to know to run your own business. Or you can be another ant in the colony.

Global Baloney

The media, led by Veep Gore, are insisting that we spend hundreds of billions of dollars and sacrifice hundreds of thousands of jobs to prevent global warming. What you're not seeing much of are the reports from scientists who are calling the whole thing a bunch of unsubstantiated political hogwash.

Then there's a petition that says, "There is no convincing scientific evidence that the human release of carbon dioxide, methane, or other greenhouse gases is causing (or will in the foreseeable future cause) catastrophic heating of the Earth's atmosphere and disruption of the Earth's climate. Moreover, there is substantial scientific evidence that increases in atmospheric carbon dioxide produce many beneficial effects on the natural plant and animal environments of the Earth."

Did this come from some PR agency or anti-environmentalists? No, it's a petition signed by nearly 17,000 US scientists, most trained in the fields of physics, climate science, chemistry, biology, or biochemistry. They point out that there is no basis for believing that human activity is leading to global warming.

This is disturbing news for the bad news bears. The media, as you well know, have found that bad news sells papers, so they've developed their skill for finding and exaggerating bad news, whether it's accurate or not.

More than 100 leading climatologists have denounced last year's Kyoto treaty as, "dangerously simplistic, quite ineffective, and economically destructive."

This is another case where politicians have their own agenda, and are running roughshod over scientists. It wasn't very long ago that a vocal few alarmists got the media busy scaring us about global cooling. They were wrong then and they're wrong again. Big surprise.

Loyal League Member

The term "loyal" suggests unquestioning subservience. And that's what I've run into with loyal League members. You've probably heard about the longest word in the English language, antidisestablishmentarianism, but I'll bet you've never given much thought about what it means. If you think about it, it means someone who is opposed to anyone who is opposed to the establishment.

Like you and everyone else, I was taught to believe in the establishment. We're taught this by our families, schools and the media. It then came as quite a shock to me to find that in every case, as I looked into what the establishment was doing, I found it was phony.

Down through the years I've known quite a few of the ARRL directors personally. I can't remember *any* who did not hold the local ARRL members in contempt. One of the directors, many years ago, made the mistake of sending letters to the other directors telling what he and they were thinking. Copies of his letters got around, with some being sent to me. These were the infamous Doyle letters.

As I understood it, Doyle was the midwest director and he'd made his money as a war profiteer. He was blunt about how stupid he thought most of the ARRL members were, and he put in writing that Budlong, the General Manager, had no problem making sure that the directors he wanted would get elected, and none other. He expressed his annoyance when the Louisiana members elected a "Hymie" lawyer as their director.

A few years later multi-millionaire Mort Kahn W2KR bought his way in as the Hudson Division director by sending letters to all of the Hudson Division hams. He quickly engineered the firing of Budlong and took over running the League by proxy from his director's position.

Wake-Up Call

While our old-timers are busy doing their very best to kill what's left of amateur radio with their insistence on maintaining the code barrier to a license, technology is leaving our hobby so far behind that we're more like antique collectors that technologists.

Have you been reading about WDM? That's wavelength division multiplexing and it's increasing the ability of fiber-optic systems to where one fiber will be able to deliver the entire contents of the Library of Congress in one second. As systems like this are brought on line, not just to communications centers, but into homes, the cost of communicating will be inconsequential. We're talking about being able to request any movie or old TV program when we want it.

The possibilities are mind-boggling. Many low-budget movies which have disappeared can be made available, including a wealth of 16mm films. I used to go to Cinema-16 in New York, where they showed some superb films that people would love to see, if they were available and there was some way to know about them.

An old buddy of mine, WA3YQY (he used to be W2MKO when we were in high school), is busy putting his 35mm slides into video programs, complete with commentary, à la the Civil War series on PBS. I'd love to see personal travelogue slides or videos done by people who have visited places I'd like to see — like those countries in West Africa, for instance.

Fifteen years ago I got an inside look at a service being pioneered in England where homes were wired with cable and the customers could request any movie they wanted when they wanted it. The system also provided for shopping, too, with customers able to request video information on a wide variety of products.

The Internet is getting close to this, so it won't be long before we'll be able to see a manufacturer's demonstration and sales pitch for almost any product (or service), and then be able to price shop for a supplier. Eventually this approach could eliminate most of the middlemen now needed — like sales reps, distributors and even retailers. Manufacturers could almost all sell direct. Maybe this is a good time to start selling any stocks you have in distributing companies.

Many of the bulkier and heavier products will have to be delivered from local warehouses, but there won't be the overhead of an expensive storefront, salesmen, management, and retail advertising.

Meanwhile, we amateurs are speeding along at 13 words per minute. Snore.

Hong Kong

Having visited Hong Kong many times, and having some good friends living there, I tend to pay more attention to news about the city than you might. It should be no surprise that despite promises and agreements, China has been slowly taking away freedom from the people. A new move could seriously undermine Hong Kong's future. The government has recently stopped teaching in English in all but 100 selected schools. Since the main future of business is in high technology, and since English is the only true international technology language, this move could severely hobble Hong Kong's coming generation of engineers and technicians.

Hong Kong's main competitor is Singapore, but India is coming up fast, with an abundance of well educated engineers who can speak and write excellent English.

Iridium

Iridium's 66 satellites are beginning to be used, but I suspect there are some serious problems with the system which may not be revealed. Like what? Like the problem of getting a line-of-sight shot at the satellites when you're in a city full of tall buildings. Which is where most cell phone users seem to be. Iridium's CEO says that 85% of Iridium calls are completed. They're aiming at soon having 98% of them completed.

Well, I suppose if you're a frequent visitor to the Australian outback this service could be handy.

This stuff isn't cheap, at least not yet. The phone costs $3,395, plus a $69 a month service charge, and $2 to $7 a minute for calls. I can't think of anyone I want to talk with that badly.

With the overhead of all those satellites, it's no wonder the service is expensive. It costs a bazillion to put them up there, plus all the earth stations to link them. US calls are forwarded to Arizona, where a computer makes sure your bill has been paid before forwarding your call, usually through a fiber-optic cable, to the city you're calling.

It'll be a while before little problems such as taking the phone through customs of some countries is worked out, as well as the telephoning costs from different countries.

But the voice quality is superb, so that's a plus. Jim Hong KA8ZGP had a beta unit with him at Aspen, so I was able to talk right from the ski slopes in Aspen to my friend Rob Burr in Coral Gables as a test with a beautifully clear connection. Well, there's a slight delay due to the distance to and from the satellites. A fraction of a second, but it takes getting used to. It reminded me of the many ham satellite contacts I made.

Melatonic

Reader Ron N2ARQ sent me some interesting data on melatonin via a doctor newsletter. Recent research has shown that the body's ability to make melatonin is very important to its health and that supplements, while helpful, are not nearly as effective. So what can you do to keep your body generating melatonin? One important factor is keeping your bedroom dark. Even a short exposure to light stops melatonic production. And it isn't just your eyes that sense light. Researchers have shown that the back of the knee is almost as sensitive to light as your eyes.

Well, we know that rabbits are able to sense changes in light with some sort of sensing system on the back of their neck, so that isn't really surprising.

Another melatonic stopper is EMFs from a nearby clock, radio, or TV set. Keep 'em at least six feet away from your bed. The worst EMF offenders are electric blankets. It's no wonder researchers have tied cancer, birth defects, and miscarriages to them.

The light during nighttime bathroom trips can interrupt your melatonic production. You'll do better if you can use a small night light so you won't have to turn on the regular light. One of those tiny wall lights that turn on when the lights go off and make it so you can walk around.

If you know someone who is hard to get along with, sleeps far too many hours a night, and is depressed and tired, you might see if they are sleeping with a room light on or a TV. I know this sounds crazy, but there are a few people who leave their TV on all night and somehow manage to sleep (fitfully) through the light and noise. These are generally not pleasant people to be around or deal with.

Smaller Is Better!

Platt Monfort has self-published a delightful little book, *Evolution — The Next Step*. In it he points out that mankind has grown a foot in the last 150 years, and with the need for even bigger basketball players, we're doing our best to add still another foot to our height.

But how about making us smaller? Platt makes a very good case for this, pointing out that our ancestors were much smaller (remember Lucie?). If we cut back to three-foot people we'd be able to have much smaller cars that would use less fuel, have homes an eighth the current size, and need to grow an eighth as much food.

That's right, an eighth! Think about it. If you take a two-foot cube and take a one-foot cube out of it, you've still seven one-foot cubes left.

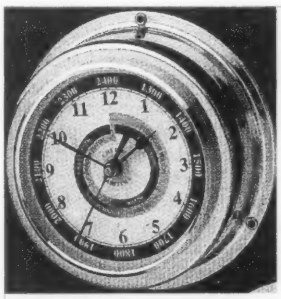
And smaller is stronger. An ant can lift 15 times its own weight. And run with it.

We could fit eight times as many people into planes. And trains, if we're still using 'em.

The booklet (25 pages) is a fun read and makes sense. It's $4 from Platt Monfort, 50 Haskell Road, Westport ME 04578.

If you've visited the *Mayflower* you've been surprised at how small the bunks were. Well, they fit the people in those days. Ditto if you've seen the beds in the old castles. People were shorter, Randy Newman notwithstanding.

With three-foot people our compact cars could really be compact! Our computer keyboards would be smaller, houses 1/2-size, and our food supply would go eight times



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farther. Hey, Munchkin Land!

Alien Implants

UFOs, alien abductions, crop circles, and other such mumbo-jumbo tabloid crapola have many people in denial. Most of the stuff I've seen on TV has been sensationalized and seems more aimed at discrediting what's going on than informing us. To get more reliable information you really have to be able to read, a skill that's no longer being taught in our schools and which seems by most people to be considered possibly satanic.

In the hopes that there are still some people who are interested in being informed, I've been reviewing books I've found to be reliable on these offbeat subjects ... in the hopes that I can convince at least a few people to inform themselves beyond the TV and tabloid fare.

It takes a pathological skeptic to remain unconvinced that there are thousands of people who have had alien abduction experiences. Professor Mack, the Pulitzer Prize–winning Harvard psychiatrist, reported in *Abduction — Human Encounters With Aliens* on his research into the subject. But I couldn't get you to spend $7 for the pocket book edition. Or to spend $5 for Whitley Strieber's *Communion*, the story of his many alien encounters. Is it that people are too cheap to spend the five bucks, or too busy watching Roseanne and Jerry Springer? Or ball games? What an incredible waste of time!

So what brought on this unprovoked attack on your smug complacency? Yeah, I've just read another book you should read, but probably won't. It provoked me.

The book, *The Aliens and the Scalpel* by Dr. Roger Leir — subtitled, "Scientific Proof of Extraterrestrial Implants in Humans" — is a narrative account of Dr. Leir's experience in removing implants from abductees. I've seen some video of implant removals by Dr. Leir, and I've talked with the chap who's worked with him on the project, Derrel Sims. This stuff is real. It's happening.

The book, by Granite Publishing, Box 1429, Columbus NC 28722, ISBN 1-893183-02-5, is a $19 232-page paperback. It has a section of color photographs of implant removals and electron photomicrographs of the implants. These implants were discovered by accident through x-rays taken for other reasons and they've been found behind an ear, in a toe, a jaw, and so on. It's a fascinating story.

So what's going on with all this alien abduction stuff? Well, some time ago I reviewed Jacobs' *The Threat — The Secret Alien Agenda* for you. It explains what the aliens really want, and how they plan to get it. This book was the result of hundreds of interviews with abductees, mostly regressed under hypnosis. Their stories were remarkably consistent, once they were enabled to recall their abduction experiences.

Dr. Leir's book shows that there is now physical proof that something strange is going on. No, we don't yet understand the technology used in the implants, but then if a Pentium chip had been sent back in time just a few years the resources of the whole world wouldn't have been able to either understand what it was or to how to replicate it.

Most of the abductions involve the "greys," which apparently are some kind of biological robot. They communicate with abductees mentally and are able to pass through walls, windows and doors, to fly through the air, and also enable abductees to do the same. Weird stuff. Well, I'm not going to try and give you all the details that have been found by researchers so far — I'm just trying to get you to start reading so you can find out for yourself what's known so far.

Tea Leaves

You don't see many gypsy fortunetellers these days. I still remember my first tea leaf reading. Let me tell you about it.

Tom Jones, a Lt. Commander in the Naval Reserve, who had been working for my father on American Export Airlines, was called back for active duty in Washington when World War II started. So, when I decided it might be wiser for me to enlist than wait to be drafted, I called Tom and asked his advice. He knew about my amateur radio background, so he arranged an interview for me with Commander Bourne at the Naval Research Labs in Anticostia, Virginia, just across the river from Washington.

Bourne was favorably impressed and arranged for me to be inducted into the Navy in Washington and then for me to go through the Navy's nine-month radar school course so I could come up to speed on all the classified electronic developments.

After being inducted as a Radio Technician 3rd Class they took me to the Washington DC Navy Yard, where they explained that since they were out of uniforms right then I should come back in two weeks. Well, this was right before Christmas, so I'd be able to spend the holidays with my folks in New York. Great!

They gave me leave papers which said that I was exempt from the law which required all service personnel to wear uniforms when in public.

Cut to my grandmother and I Christmas shopping in New York and stopping at a gypsy tea room on Fifth Avenue for lunch. After lunch a gypsy came over and looked at the tea leaves left in my cup and was puzzled. She said she saw me being in the military, even though I was in civvies. She said that a TJ had recently had a big influence on my life and that I would soon be joining many others, going into a large building where I would come out with top honors.

Because I had always just squeaked by in school this didn't make a lot of sense to me. But she was right. When I returned from leave I got a pile of ill-fitting blues and a bunk in the barracks right below where the Navy band practiced every day, starting at 6 AM. What a great wake-up system.

A few days later I started school at the Bliss Electrical School in Tacoma Park, Maryland, which was on the outskirts of Washington. Three months later I graduated, top in my class. Well, the course was superb and a lot of fun. From there I opted for the Radio Materiel School on Treasure Island in San Francisco.

This school, too, was incredible! Six months later I graduated as an RT2/c. Then I had one of the biggest decisions of my life to make ... should I call Commander Bourne to cut orders transferring me to his research lab or should I join the fleet. And that's a great story which I'll tell you about some time.

When I tell people that my interest in amateur radio has brought me a lifetime of adventure, I'm not exaggerating.

The Best and Brightest?

A note from reader Guy Tanner pointed out that each new president is so bad that we tend to forget just how terrible his predecessor was.

I hope no one will argue with me that our political system has not done much of a job of electing the best and brightest of people. We were pretty happy with Reagan, the first movie star we'd ever elected. He did a nice job of playing president. But beyond that we've generally made the best we could of lousy choices.

I never shared the enthusiasm for Roosevelt. I liked Truman and Ike, but distrusted Nixon from the beginning. Kennedy was a nice chap, but I thought he was in way over his head with the job. Johnson? Ugh. Ford? Har-de-har. Carter? Give me a break! Bush? What is the matter with our political system, anyway? How did that turkey get elected? Clinton? No comment. Perot? Good grief, what a choice we had!

I suspect that smart people know better than to get into politics. From the congressmen

Continued on page 61

Number 61 on your Feedback card

Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Hancock Rd., Peterborough NH 03458 and get set for the phone calls. The deadline for the August 1999 classified ad section is June 10, 1999.

President Clinton probably doesn't have a copy of *Tormet's Electronics Bench Reference* but you should. check it out at **[www.ohio.net/~rtormet/index.htm]**—over 100 pages of circuits, tables, RF design information, sources, etc. BNB530

DFjr direction finder and MicroPLL programmable transmitter (formerly Agrelo) are now back under new management! Check exciting new accessories and upgrades. Order online at **www.swssec.com** or call SWS Security at 410-879-4035 (9-5 ET). BNB220

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Wanted: ICOM IC-970. Must be in mint condition, non smoker. Also looking for the following ICOM sales brochures: IC-275, 575, 375 and 970. **Randy Ballard N5WV**, (903) 687-3002. BNB75

TELEGRAPH COLLECTOR'S PRICE GUIDE: 250 pictures/prices. $12 postpaid. **ARTIFAX BOOKS**, Box 88, Maynard MA 01754. Telegraph Museum: [http://wltp.com]. BNB113

NEVER SAY DIE

continued from page 60

I've known, that rule fits. It's like trying to find a good teacher. When it's the bottom 20% of the high school graduating classes that go to ed schools so they can get a license to join the teacher's union and never have to worry about getting fired, the likelihood of a smart teacher managing to survive the system is minuscule. It wasn't as bad 60 years ago when I went to school, yet in my 17 years of school I had exactly two good teachers — one in high school (art), and one in college (accounting).

Sigh, if I could just convince you to get as many people as you can to Never Re-elect Anyone (NRA), we'd go a long way toward solving the campaign financing mess, and we'd soon get rid of professional politicians. If we lose a few good ones along with the crooks, it's a sustainable loss.

The system is obviously not going to fix itself. The foxes are running the chicken coop, so it's up to the public to take its eyes off Jerry Springer and ball games long enough to change things.

Bush was a crummy president, but he wasn't as bad as Clinton.

The Other Shoe

Since the Kenneth Starr investigation started with Whitewater, even a not very perceptive person might wonder how come the released Starr report didn't mention this. This will, I suspect, be the other shoe to drop.

Between the leaks and White House spinmeisters, anyone can be forgiven for being confused about the Whitewater mess. Maybe I can clarify it for you.

This all started back in Arkansas where the Clintons were partners with Jim and Susan McDougal in the Whitewater Development Corporation. The accounts were kept in the Madison Guarantee Savings & Loan, run by Jim McDougal, with Hillary Clinton as an attorney. When federal bank examiners checked Madison they testified that it was a "politically corrupt institution that routed millions of dollars to politically connected Arkansans." The report cited wire fraud, illegal campaign contributions, embezzlement, money laundering, falsification of loan records and board minutes, etc. The FDIC had to cover over $60 million that was looted.

Part of the money stolen by McDougal and Hillary went to Bill Clinton's campaign account.

The reason a special prosecutor had to be called in was the obstruction of investigations at both the state and federal levels by the Clintons, the same pattern we've seen repeated with Bill's sex scandals. 73

PROPAGATION

Jim Gray W1XU/7
210 E Chateau Circle
Payson AZ 85541
[jimpeg@netzone.com]

May 1st–3rd are expected to reveal a disturbed (D) magnetic field and upset to active ionosphere, resulting in Very Poor to Poor (VP–P) HF propagation. High signal absorption is expected on 80, 40, and 30 meters, rendering the bands essentially useless during major parts of the day.

There could be band "wipeouts" on 20 meters and higher during the next few days, with only weak and watery-sounding signals on polar paths. Gradual improvement should be noted on the 4th and 5th, with good (G) propagation conditions returning on the 7th, and lasting for about a week.

Thereafter, propagation will be only fair until the 16th and 17th, when the ionosphere will become upset once again, and poor conditions prevail. A slight recovery should last for a day or two. Poor and upset conditions are likely to return between the 21st and the 24th. Only gradual improvement will take place until the 29th, when Poor to Very Poor propagation is expected to return and continue through the end of the month.

Use the calendar to plan your *best* HF operating days (4th–15th, 19th, and 25th–28th). Look at 6 and 2 meters for good VHF-DX openings on May 1st, 22nd, 30th and 31st.

Band-by-band Forecast for May

10–12 Meters

Expect morning F2 path openings to Europe and Africa on G days, midday path openings to South and Central America, and F2 path openings to Japan, Australasia, and the Pacific during the afternoon at your location. DX moves west as the day progresses.

15–17 Meters

Expect good DX paths to most areas of the world, with excellent openings from the northern hemisphere to Africa, South America, and the Pacific during hours of daylight and peaking during local afternoon. Good short-skip communication over 1,000 miles will occur on G days.

20 Meters

Very good DX openings to all areas of the world from sunrise through the early darkness hours. The signals will peak an hour or two after sunrise at your location, and again during the afternoon. Short skip beyond about 700 miles will occur during daytime hours.

30–40 Meters

Good worldwide DX openings from sunset to sunrise should occur on G days. Noise levels (static) will be higher as spring thunderstorms occur, and can depress audibility. Short skip between 100 and 1,000 miles will occur during daylight hours, and distances beyond 1,000 miles at night.

80–160 Meters

On 80, DX to the southern hemisphere and also to Europe should occur after dark and during sunrise hours—limited, of course, by static noise levels. Daytime short skip to about 350 miles, and beyond 500 miles after dark, will prevail on G days. On 160, no daytime propagation will occur due to ionospheric absorption of signals, but after dark and peaking around midnight, and again during the pre-dawn hours, you should be able to "work" many areas of the world. Short skip from 1,000–2,000 miles or so will prevail during the nighttime hours ... *but*, as always, it will be limited by high static levels from thunderstorm activity. W1XU/7. 73

May 1999

SUN	MON	TUE	WED	THU	FRI	SAT
						1 VP-P/D
2 P/D	**3** P-F	**4** F	**5** F	**6** F-G	**7** G	**8** G
9 G	**10** G	**11** G-F	**12** F	**13** F-G	**14** G-F	**15** F
16 F-P	**17** P	**18** P-F	**19** F	**20** F-P	**21** P/D	**22** P
23 P	**24** P-F	**25** F-P	**26** P-F	**27** F	**28** F	**29** F-P
30 P/D	**31** VP/D					

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15/17											15/17
ARGENTINA	20	20	30/40							10/12	10/12	15/17
AUSTRALIA	15/17				30/40	30/40	20	20			20	15/17
CANAL ZONE	20	30/40	30/40				20	20		10/12	10/12	20
ENGLAND	20		30/40	30/40				10/12	15/17	15/17	20	20
HAWAII	15/17			80	30/40	30/40	30/40				10/12	15/17
INDIA												
JAPAN	20						20	20	15/17	15/17	15/17	20
MEXICO	20/30	30/40	30/40				20	20		15/17	15/17	30/40
PHILIPPINES							17/20	17/20				
PUERTO RICO	30/40	40/80	40/80	40/80	40/80	40/80		17/20	10/12	10/12	15/17	15/17
RUSSIA (C.I.S.)	30/40						20/30	17/20	17/20			
SOUTH AFRICA			20/30					10/12	10/12	17/20	17/20	30/40
WEST COAST												

CENTRAL UNITED STATES TO:

ALASKA	14/20	17/20	17/20		30/40	30/40				17/20	15/17	15/17
ARGENTINA	17/20	30/40									10/12	15/17
AUSTRALIA					30/40	10/12	17/20	17/20				15/17
CANAL ZONE	20	30		30/40	30/40			17/20	10/12	10/12	15/17	17/20
ENGLAND			40/80		30/40	30/40			15/17	17/20	20	
HAWAII	15/17	20/30			40/80	40/80	40/80	20/30			10/12	12/15
INDIA								20/30	17/20			
JAPAN	15/17	17/20				20/40	40/80	17/20				15/17
MEXICO	20	30		30/40	30/40			17/20	10/12	17/20	20	
PHILIPPINES	17/20	30/40					17/20	20/30				15/17
PUERTO RICO	20	30		30/40	30/40			17/20	10/12	15/17	20	
RUSSIA (C.I.S.)			30/40						15/17	17/20	20	
SOUTH AFRICA	17/20								10/12	17/20		17/20

WESTERN UNITED STATES TO:

ALASKA	15/17	15/17	17/20			30/40	30/40					
ARGENTINA	10/12	15/17	20	30				30			15/17	10/12
AUSTRALIA	15/17	17/20					30/40					10/12
CANAL ZONE	17/20	20/30	20/30	30/40	30/40	80			15/17	10/12	10/12	17/20
ENGLAND				30/40	40/80				15/17	15/17	17/20	20
HAWAII	15/17	20/30						20/30	20/30		10/12	10/12
INDIA	17/20	20							17/20			
JAPAN	15/17	15/17	17/20			30/40	30/40					
MEXICO	17/20	20/30	20/30	30/40	30/40	30			15/17	10/12	10/12	17/20
PHILIPPINES	15/17	17/20	20	20		30/40			17/20	17/20		
PUERTO RICO	17/20	20/30	20/30	30/40	30/40	80			15/17	10/12	10/12	17/20
RUSSIA (C.I.S.)				30/40				20	15/17	20	17/20	
SOUTH AFRICA	20								17/20	15/17	17/20	20
EAST COAST												

Say You Saw It In *73*!

Radio Bookshop

Here are some of the books Wayne has written. Some can change your life, if you'll let them. If the idea of being healthy, wealthy and wise is of interest to you, start reading. Yes, you can be all that, but only when you know the secrets which Wayne has spent a lifetime uncovering.

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some very difficult changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products. $5 (H)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (M)

The Secret Guide to Wisdom: This is a review of around a hundred books that will help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. $5 (B)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (C)

The Bioelectrifier Handbook: This explains how to build or buy a little electrical gadget that can help clean the blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, patented, and then hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. The circuit can be built for under $20 from the instructions in the book. $10 (A)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the videos, looked carefully at the photos, read the astronaughts' biographies, and talked with some of my readers who worked for NASA. This book cites 25 good reasons I believe the whole Apollo program had to have been faked. $5 (D)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe us all out are right, we're in trouble. In this book I explain about the various disaster scenarios, from Nostradamus, who says the poles will soon shift, wiping out 97% of mankind, to Sai Baba, who has recently warned his followers to get out of Japan and Australia before March6th this year. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, or even Y2K? I'm getting ready, how about you? $5 (E)

Wayne's Submarine Adventures in WWII: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? There are some very funny stories. If you're near Mobile, please visit the Drum. $5 (S)

Improving State Government: Here are 24 ways that almost any state government can cut expenses enormously, while providing far better services. I explain how any government bureau or department can be gotten to cut its expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (L)

Travel Diaries: You can travel amazingly inexpensively – once you know the ropes.Enjoy Sherry and my budget visits to Europe, Russia, and a bunch of other interesting places. How about a first class flight to Munich, a rented Audi, driving to visit Vienna, Krakow in Poland (and the famous salt mines), Prague, back to Munich, and the first class flight home for two, all for under $1,000. Yes, when you know how you can travel inexpensively, and still stay in first class hotels. $5 (T)

Wayne's Caribbean Adventures: More budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. Like the special Liat fare which allowed us to visit 11 countries in 21 days, with me diving all but one of the islands, Guadeloupe, where the hams kept me so busy with parties I didn't have time to dive. $5 (U)

Silver Wire: With two 3" pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (Y)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngsters' IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (Z)

Reprints of My Editorials from *73*.

Grist I: 50 of my best non-ham oriented editorials from before 1997. $5 (F)

Grist II: 50 more choice non-ham editorials from before 1997. $5 (G)

1997 Editorials: 240 pages. 216 editorials discussing health, ideas for new businesses, exciting new books I've discovered, ways to cure our country's more serious problems, flight 800, the Oklahoma City bombing, more Moon madness, and so on. In three $5 volumes. $15 (O)

1999 Jan-Aug Editorials: 188 pages in two $5 volumes. Bringing you up to date. $10 (P)

Ham-to-Ham: 45 of my ham-oriented editorials. These will help you bone up on ham history. Great stuff for ham club newsletter filler. Yes, of course these are controversial. $5 (Q)

$1 Million Sales Video: How to generate extra million in sales using PR. This will be one of the best investments your business ever made. $43 (V)

One Hour CW: Using this sneaky method even *you* can learn the Morse Code in one hour and pass that dumb 5wpm Tech-Plus ham test. $5. (CW)

Code Tape (T5): This tape will teach you the letters, numbers and punctuation you need to know if you are going on to learn the code at 13 wpm or 20 wpm. $5 (T5)

Code Tape (T13): Once you know the code for the letters (T5) you can go immediately to copying 13 wpm code (using my system). This should only take two or three days. $5 (T13)

Code Tape (T20): Start right out at 20 wpm and master it in a weekend for your Extra Class license. $5 (T20)

Code Tape (T25): Same deal. It doesn't take any longer to handle 25 wpm as it does 13. Or use the ARRL system & take six months.$5 (T25)

Wayne Talks at Dayton: This is a 90-minute tape of the talk I'd have given at the Dayton, if invited. $5 (W1)

Wayne Talks at Tampa: This is the talk I gave at the Tampa Global Sciences conference. I cover cold fusion, amateur radio, health, books you should read, and so on. $5 (W2)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $25 (R1)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $25 (R2)

Elemental Energy Subscription: I predict this is going to be the largest industry in the world in about 20-30 years. They laughed at me when I predicted the personal computer growth in 1975. PCs are now the third largest industry in the world. The elemental energy ground floor is still wide open, but then that might mean giving up watching ball games and talk shows on the boob tube. $30 for six issues. (EE). A sample issue is $10.

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (K)

.....Wayne

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Yes! Put me down for a year of *73* for only $25 (a steal). Canada US$32. Foreign US$44 by sea, US$67 by air. Whew!

Go Mobile, get there with COMET!

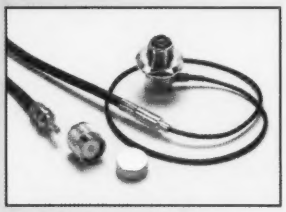
Lip Mounts

RS-720 • RS-720 NMO Multi-adjustable lip mount, up to 60" antenna RS-720 NMO accepts an NMO mount

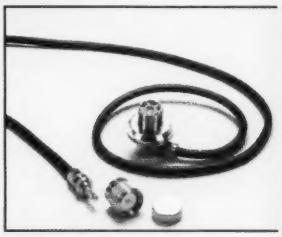
RS-730 Multi-adjustable heavy duty lip mount, up to 70" antenna

RS-520 Multi-adjustable lip mount, up to 45" antenna

Cable Assemblies for Lip Mounts



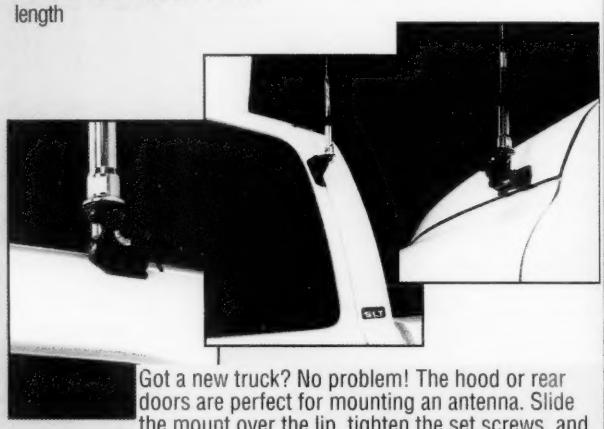
CK-3M5 Deluxe cable assembly 17' length including 17" of RG-188A/U for easy entry from a lip mount without causing water leak, wind noise or coax damage
CK-3M Deluxe cable assembly same as CK-3M5, but 9'9" total length



3D5M Standard low loss cable assembly. Gold plated SO-239/PL-259 connectors. 17' length
3D4M Same as 3D5M, but 13.5' length

The **GR-5M's** smooth rounded corners make an attractive stainless steel mount strong enough to hold the biggest antennas.

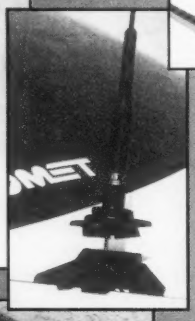
GR-5M Deluxe trunk lip mount. Rubber coated base protects the vehicles paint. All stainless steel, includes the CK-3M5 deluxe cable assembly to avid water leads/cable damage when shutting the trunk. Four large set screws hold it securely in place. Two offset washers adjust the antenna to vertical. Gold-plated SO-239/PL-259 connectors.

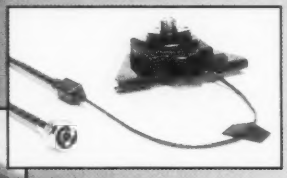


Got a new truck? No problem! The hood or rear doors are perfect for mounting an antenna. Slide the mount over the lip. tighten the set screws, and adjust it to vertical. No holes to drill, the mount is grounded and installation takes only a few minutes. Choose the deluxe or standard cable assembly in the length required.

A

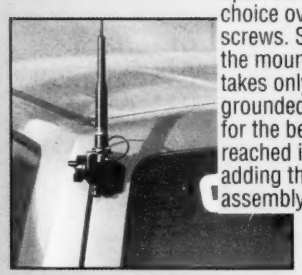
B





CQ-5M "Quick-disconnect" trunk lip mount. Rubber coasted-base protects the vehicles paint. Includes the CK-3M5 deluxe cable assembly avoiding water leaks or cable damage when shutting the trunk. Gold-plated SO-239/PL-259 connectors.

C



Going mobile is easy with **COMET** products, and there are no holes to drill. The rear doors on VAN's and SUV's are the perfect place to mount an antenna. Simply lift or open the rear door, slide your mount of choice over the lip, then tighten the set screws. Soft rubber protects the paint, and the mount adjusts to vertical. Installation takes only a few minutes. The mount is grounded,the antenna is above the roof line for the best performance and is still easily reached if needed. Complete the system by adding the standard or deluxe cable assembly in the appropriate length.

COMET's newest and most unique truck lip mount, the CQ-5M. Mounts to any trunk lid and adjusts to vertical with two offset washers. The mount base supports even the largest dualband or HF antenna.
A) CQ-5M trunk lip mount with **COMET** SBB-2 2M/70cm antenna.
B) Quick-disconnect lever releases the antenna and connector for long term storage in your trunk, to use a car wash, or theft prevention.
C) The low profile base is the only thing that remains when the antenna is removed, ready for instant re-attachment.

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W MH-209SMA • Dual-band 146/446MHz HT Antenna w/SMA Conn
& Wave: 0 1/4 wave • Length: 3" Flexible rubber • Conn: Male SMA • Max Pwr: 5W

W SMA-503 • Dual-band 146/446MHz HT Antenna w/SMA Conn
un: 8.75" • Conn: Male SMA • Max Pwr: 10W

W MH-510 • Tri-band 52/146/446MHz HT Antenna w/SMA Conn
: 0/0/ 3.2dBi • Length: 20.75" • Conn: Male SMA • Max Pwr: 10W

SB-15 • Tri-band 52/146/446MHz w/fold-over
Gain & Wave: 52MHz 0dBi 1/4 wave • 146MHz 4.5 dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 • Length: 58" • Conn: PL-259 • Max Pwr: 120W

SBB-7 SBB-7NMO • Dual-band 146/446MHz w/fold-over NEW BLACK COLOR
Gain & Wave: 146MHz 4.5dBi 6/8 wave • 446MHz 7.2dBi 5/8 wave x 3 • Length: 58" • Conn: SBB-7 PL-259/SBB-7NMO NMO • Max Pwr: 70W

SBB-5 SBB-5NMO • Dual-band 146/446MHz w/fold-over NEW BLACK COLOR
Gain & Wave: 146MHz 2.5dBi1/2 wave • 446MHz 5.5dBi 5/8 wave x 2 • Length: 39" • Conn: SBB-5 PL-259/SBB-5NMO NMO • Max Pwr: 120W

THEFT **Z750** • Dual-band 146/446MHz w/fold-over • Includes COMET exclusive theft-resistant lock!
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 446MHz 5.5dBi 5/8 wave x 2 • Length: 39" • Conn. Gold-plated PL-259 • Max Pwr: 200W

THEFT **Z760** • Dual-band 146/446MHz w/fold-over • Includes COMET exclusive theft-resistant lock!
146MHz 6/8 wave 4.5dBi • 446MHz 5/8 wave x 3 7.2dBi • Length: 62" • Conn: Gold-plated PL-259 • Max Pwr: 150W

B-20 B-20NMO • Dual-band 146/446MHz w/fold-over
Gain & Wave: 146MHz 2.15dBi 1/2 wave • 446MHz 5.0dBi 5/8 wave x 2 • Length: 30" •
Conn: B-20 PL-259/B-20NMO NMO • Max Pwr: 50W

B-10 B-10NMO • Dual-band 146/446MHz cellular look-a-like •
Gain & Wave: 146MHz 0dBi 1/4 wave • 446MHz 2.15dBi 1/2 wave • Length: 12" •
Conn: B-10 PL-259/B-10NMO NMO • Max Pwr: 50W

- The **CA-UHV** is a 6M/2M/70cm triband antenna. Add 2-3 of the stock or optional coils for 5-6 band operation.
- HF-70cm all in one economical easy to mount antenna.
- Fold-over hinge built in.
- Select the correct duplexer or triplexer for your specific radio (s).
- CF-706A, CF-530, CFX-514N (Ask your dealer)

NEW CA-UHV • HF/6M/2M/70cm Mobile Antenna40/*20/*17/15/10/6/2M/70cm ***40M Thru 70cm!***
Gain & Wave: HF-6M 1/4 wave • 2M 3.4dBi 5/8 wave • 70cm 2.15dBi 1/2 wave • VSWR: HF 1.6:1 or less • 6M-70cm 1.5:1 or less • Length: 6'2" •
Max Pwr: HF 120W SSB • 6M 200W SSB/100W FM • 2M/70cm 100W FM • *L-14 Optional 20M coil • *L-18 Optional 17M coil

* **NEW MSG-1000C** • Dual-band 146/446MHz w/spring whip and fold-over
Gain & Wave: 146MHz 2.15dBi1/2 wave • 446MHz 5.5dBi 5/8 wave x 2 • Length: 39" • Conn: PL-259 • Max Pwr: 120W

* **NEW MSG-1100C** • Dual-band 146/446MHz w/spring whip and fold-over
Gain & Wave: 146MHz 3.5dBi1/2 wave • 446MHz 6.0dBi 5/8 wave x 2 • Length: 43" • Conn: PL-259 • Max Pwr: 150W

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The Kachina 505DSP Computer Controlled Transceiver

Features:

- Works with any Computer Running Windows 3.1, 95 or NT
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- IF Stage 16/24 Bit Digital Signal Processing (DSP)
- II DSP Bandpass Filter Widths from 100 Hz to 3.5 kHz (6 kHz in AM Mode)
- Band Activity Display with "Point and Click" Frequency Tuning
- On-screen Antenna "Smith" Chart, Logging Software and Help Menus
- Automatic Frequency Calibration from WWV or Other External Standard
- "Snapshot" Keys for Instant Recall of Frequencies and Settings
- Optional Internal Antenna Tuner

The Kachina 505DSP Computer Controlled HF Transceiver After twenty years of building commercial transceivers in Arizona, Kachina has decided the time is right for a new approach to amateur radio. The Kachina 505DSP is nothing short of a revolution in HF transceivers.

Why Use Knobs if You Have Windows? The old-fashioned front panel has become too cluttered to be useful. Too many knobs, too many buttons. Kachina's 505DSP transceiver connects to your computer's serial port and is completely controlled under Windows™. With optional cables, the radio may be remotely located up to 75 feet away from your computer. Imagine combining a state-of-the-art DSP transceiver with the processing power and graphics capabilities of your PC and you'll soon wonder why all radios aren't designed this way. Why settle for a tiny LCD display when your computer monitor can simultaneously show band activity, antenna impedance, heat sink temperature, SWR, forward and/or reflected power and a host of other information?

16/24 Bit DSP/DDS Performance In addition to 100% computer control, the Kachina 505DSP offers exceptional 16/24 bit DSP/DDS performance. IF stage DSP, "brick-wall" digital filtering, adaptive notch filters and digital noise reduction, combined with low in-band IMD and high signal-to-noise ratio, produce an excellent sounding receiver. Sophisticated DSP technology achieves performance levels unimaginable in the analog world. The transmitter also benefits from precise 16/24 bit processing. Excellent carrier and opposite-sideband suppression is obtained using superior phasing-method algorithms. The RF compressor will add *lots* of punch to your transmitted signal without adding lots of bandwidth, and the TX equalizer will allow you to tailor your transmitted audio for more highs or lows.

Seeing is Believing American-made and designed, and able to stand on its own against the world's best, the 505DSP is bound to set the standard for all that follow. But don't take our word for it. Visit our website at http://www.kachina-az.com for detailed specifications, to download a demo version of our control software, or to see a current list of Kachina dealers displaying demonstration models in their showrooms.

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